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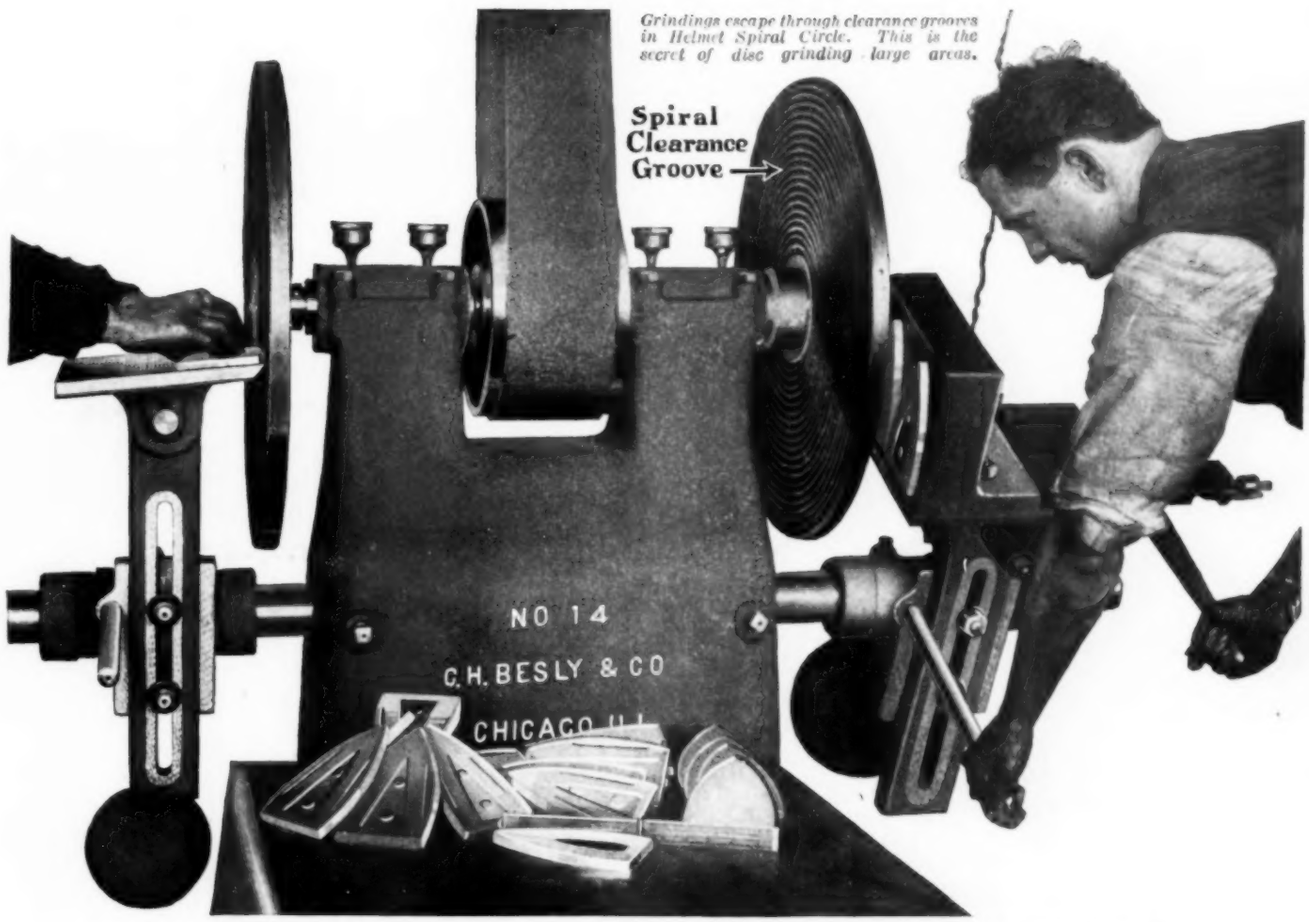
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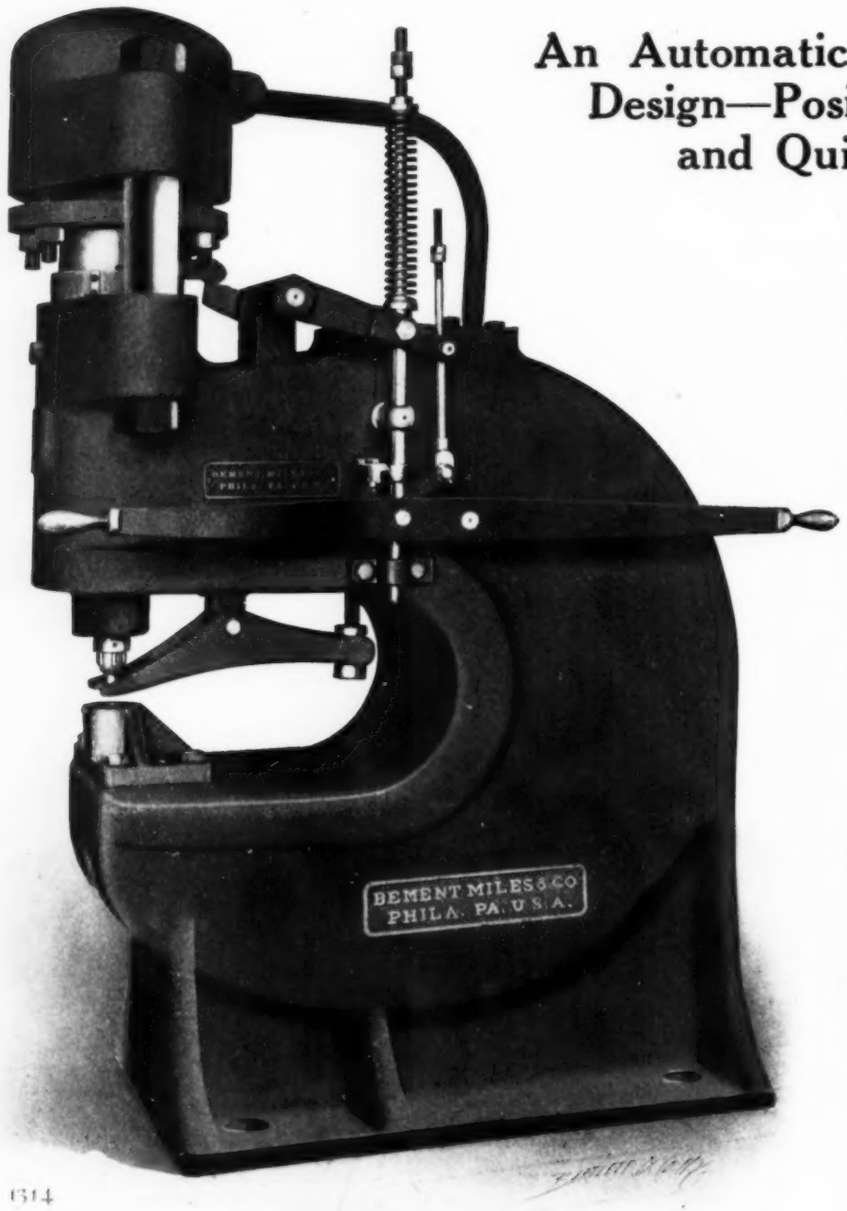

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Manufacturing Shot Gun Barrels

By Frank A. Stanley

The many operations in the manufacture of shot gun barrels include welding up of the original tube, drilling, reaming, straightening, fitting and milling of lugs and ribs, polishing and browning.

These processes require special machines and tools, by means of which both plain and beautifully figured Damascus barrels are finished for single and double guns.

The methods used by a well known New England gun manufacturer.

As most readers of the AMERICAN MACHINIST are aware, the Hopkins & Allen Arms Company, of Norwich, Conn., has been engaged for many years in the manufacture of a varied line of fire arms, including single- and double-barrel shot guns, small-caliber rifles and revolvers of different types. As might be expected this company's factory is filled with interesting machines and special tools and the processes of manufacture as carried on there are of a nature sure to appeal to the mechanic.

It is, of course, impossible, within the limits of a series of articles in this journal, to cover thoroughly the details of all the operations through which the parts of a shot gun or a revolver pass before completion. For this reason illustrations have been selected which show only the more important and more interesting processes, of which, however, there are a large number. These illustrations and the data for the descriptive matter have been secured through the courtesy and coöperation of General Manager Charles B. Lee and Superintendent Arthur C. Wright.

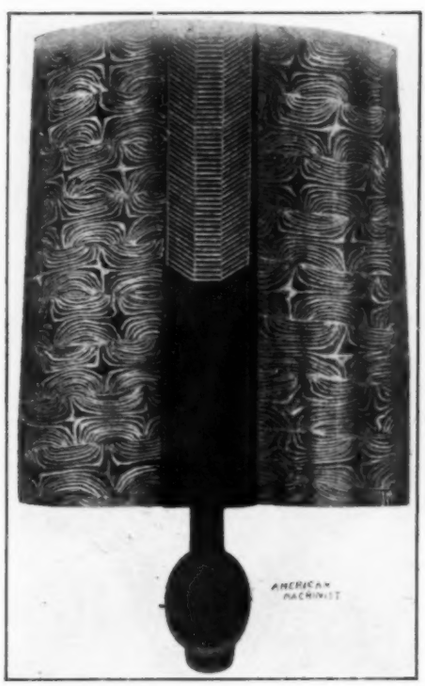


FIG. .. BREECH END OF A PAIR OF DAMASCUS GUN BARRELS

A good many of the special machines and attachments employed in this factory, as well as special tools of the jig and fixture class, were either devised and built directly by Mr. Wright or constructed to his designs. They are the outgrowth of his many years of practical experience in revolver and gun manufacture and naturally they facilitate and simplify greatly the production of various parts entering into fire-arm construction.

SHOT-GUN BARREL OPERATIONS

As the barrel may be considered the most important member of the shot gun this first article on Hopkins & Allen methods will be confined to the tools and processes employed in barrel manufacture.

Many of the shot-gun barrels used at this place are imported, particularly those of the twist and laminated types, these being received at the factory with the bore machined to within about 0.005 inch, while the plain barrels are made at the factory from solid stock.

The process of welding up a Damascus barrel with its beautifully twisted figure repeating itself at intervals around the tube and along its surface, but giving throughout the length of the barrel a variety of curves and patterns, as in Fig. 1, is somewhat complicated. The general method may be outlined briefly as follows:

BUILDING UP DAMASCUS BARRELS

A number of thin charcoal-iron and steel plates are first welded together in alternate arrangement until the required number of layers is obtained, depending upon the size and character of the pattern desired in the barrel. From this composite block of metal, strips are cut in the form of ribbons, each, of course, composed of as many laminations as there were sheets of steel and iron in the original welded material. These composite ribbons are then twisted as indicated at *A*, Fig. 2, after which a number of them are butt welded together edgewise throughout their entire length as at *B* in the same illustration. We now have a ribbon made up of the narrow and twisted strips, and the next stage is to weld this ribbon spirally upon a mandrel, thus forming a tube which is butt welded spirally from end to end as at *C*. This then is the rough barrel which after being machined internally to within a few thousandths of the required size of bore, is ready for the gun manufacturer who proceeds to finish the tube outside and in to suit his requirements. It will be clear that the character of the pattern upon the barrel is determined by the number of steel and iron strips in the ribbon, the thickness and width of the latter, the amount of twist given these ribbons and the number of strands which are welded together prior to welding spirally upon the mandrel.

The figure thus formed is not superficial, but instead extends through the entire thickness of the metal to the bore. The browning process through which the barrel is passed in finishing brings out the figured ornamentation in black and silvery-white lines, and no matter how much material may be removed from the surface of the original barrel, when this is afterward finished and browned, the pattern will still be brought out clearly upon the surface.

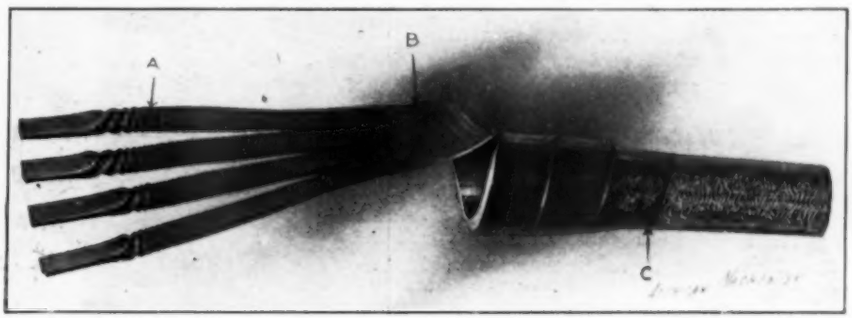


FIG. 2. DAMASCUS BARREL IN PROCESS OF CONSTRUCTION

BORING, TURNING AND STRAIGHTENING

The barrels that are made from the solid stock are bored at the shop on

Pratt & Whitney gun-barrel drilling machines bringing the bore to within 0.005 inch of finished size. In the process of boring from the solid, say a twelve-bore gun as illustrated in Fig. 3, the drill is fed at about 0.0006 to 0.0008 inch per revolution, the speed of rotation being

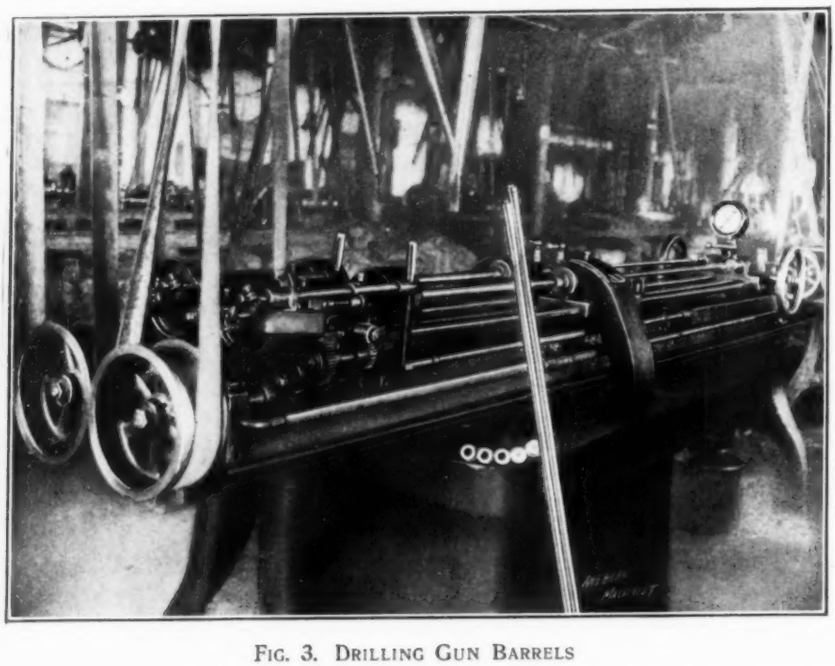


FIG. 3. DRILLING GUN BARRELS

1400 turns per minute and about 0.005 inch being left for finish reaming.

With either the twist type of barrel (which is received in its roughed-out condition) or the barrel made from the solid material, while the bore is still 0.005 small the next operation is rough turning the outside, after which the barrels are straightened by the customary process of pointing the barrel toward a window and squinting down the bore at a line on a pane of opaque glass, the reflection of this line in the bore if straight indicating that the barrel is straight; or if curved, being a sure sign that the hammer must be applied at a certain point in the length of the barrel to rectify some crooked spot. After straightening on the block by means of a hammer or mallet, the barrel is finish turned on a lathe with former bars by which the taper and the enlarged portion are produced. Following this the barrels are ground on a large, broad-face stone, past the edge of which they are fed while revolving, by the operator.

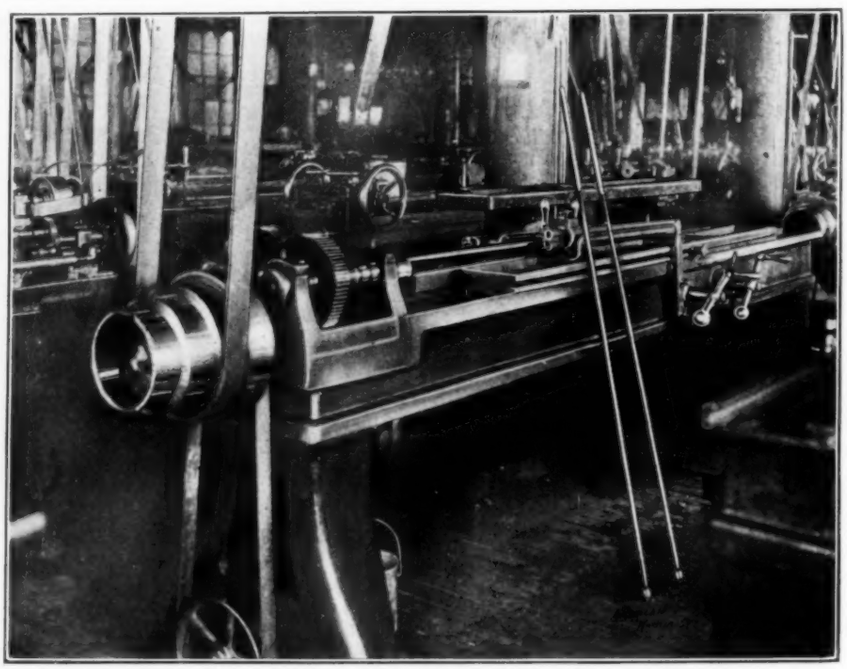


FIG. 4. REAMING GUN BARRELS

FINISH BORING OR REAMING

Now, in the case of the barrel for the single gun, the next process is brazing on the lug at the under side.

The single-gun barrel, after this lug is machined, is then ready for finish boring or reaming. This operation is accomplished by means of a four-sided tool, commonly called a "bit," only one corner of which does any cutting. Two of these bits are shown in Fig. 4, resting against the machine, which in this view is illustrated with a double-barrel job in position for reaming.

The bits have cutting heads about 12 inches long and a cross-section through the head is represented in Fig. 5. As there shown, the tool is provided with a wooden strip at one side, which is called a "chip" and which may be packed out by slips of paper placed between it and the side of the tool. The cross-section shows the position and section of the "chip"; and it will be seen that one sharp cutting corner is provided on the bit, while the corresponding corner is rounded slightly, so that the tool takes a bearing in the bore only on this rounded corner (known as the "leading corner") and on the wood strip opposite, while the sharp corner is doing the cutting.

These bits or reamers are fed through the work a number of times, the exact

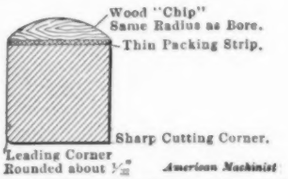


FIG. 5. SECTION THROUGH GUN-BARREL REAMER

number for any given barrel being determined by the condition of the bore after each cut. The feed given them is about 1/16 inch per revolution and the speed of rotation 70 turns per minute. They are generally drawn through the work, though often pushed through as well. After this finishing operation, the single barrel is ready for polishing by means of the apparatus illustrated in Fig. 6. Before describing this, however, brief reference may be made to "choke boring."

CHOKE BORING

Gun barrels may be bored straight, may be "full-choked" or "modified," the latter giving a reduction at the muzzle, somewhere between the "full-choke" and the straight-bore barrel. For choking, the barrels are passed through a swedging process where the muzzle end is reduced or tapered back for a distance varying from five to eight inches according to the amount of choke required.

This operation is performed to a plug gage, which shows when the end of the bore has been sufficiently reduced, and the barrel is then ready for finish reaming. The reamer in this case is tapered to conform to the choke required; for example, while the straight bore in a barrel is, say, 0.730 for a 12-gage gun, the end of the reamer which finishes the mouth for a full-choked gun, may be as small as 0.695, or in the case of a modified choke, 0.716. Different sportsmen and trap shooters have different ideas as to choke-bore guns and manufacturers naturally have a good many different combinations to put together as regards the amount of choke, etc.

Gun-barrel Polishing

The apparatus illustrated in Fig. 6 is used for polishing single-gun barrels and is adapted to reciprocate these barrels between clamps, supplied with emery and oil, at the same time imparting a rotary movement to the work, the result being that the barrel moves in a helix, between the polishing jaws. As the work rotates ahead on both up and down strokes a little consideration will show that this spiral polish is in both directions, that is, right and left hand. At the same time as the work is reciprocated between the jaws, it is also being advanced or indexed ahead so that all parts of the periphery are brought into contact with the polishing medium. After this operation is completed, the mechanism by which the barrels are given their helical movement is thrown out of action and they are then simply moved vertically, laying the polishing lines longitudinally, the indexing of the barrels, of course, continuing during this straight-ahead polishing movement.

Several barrels are handled simultaneously with each machine, as clearly brought out in the illustration, which also shows the pitman by which the cross head with the work is reciprocated from a crank on a shaft overhead; the engraving also indicates the position of the driving chain for rotating the work.

Operations on Double-gun Barrels

In the case of the barrels for the double gun there are a number of interesting milling operations associated with the putting together of the two barrels. Some of these are performed before, and some after, the brazing in of the lug under the barrels and the soldering of the ribs along the top and bottom. The facing sides of the enlarged portions at the breech of the barrels must be milled off to give the correct center distance at the breech and these facing cuts on each pair of barrels must, of course, be made right and left hand.

With the twisted and laminated barrels it is important that right and left barrels should not be confused; therefore in putting through lots of twisted barrels for double guns they are handled in pairs which are kept together until they have passed through the milling operations.

As the center lines of the barrels converge toward the muzzle (say 3/16 inch with a pair of 30-inch barrels) it is necessary that the sides of the breech be milled at just the right angle to give the required convergence of the barrel centers.

Milling Cuts for the Joint between the Barrels

These facing cuts for the joints between the two barrels are made with the pair of barrels held by means of suitable fixtures arranged somewhat as shown in Fig. 7, which, however, does not represent the operation described, but rather the milling of the dovetail slot which must be cut near the breech end of each barrel so that when the pair are put together the two sides of the slot form an opening for a key on the lug which is later brazed in position to hold the barrels in correct relation with each other. This milling operation is performed as indicated in Fig. 7, with the work properly supported to give the correct slope to the cut and prevent vibration during the operation.

A Rotary Milling Fixture

Another of the interesting appliances in the barrel-milling department is the worm-driven rotary arrangement illustrated in Fig. 8 for machining the enlarged taper portion of the barrel at the breech end. The fixture shown is provided with a long quill having at the front end a draw-in collet for holding the barrel snugly, this quill being removed bodily with the work upon completion of the cut by simply turning the handle *A* at the outer end, a change from one barrel to another occupying but a moment. The general form of the rotating head by which the end of the barrel is supported and the work revolved past the cutter, is clearly shown in the halftone. As will be observed, the cylindrical casting is cut away sufficiently at the sides to provide ample clearance for the cutter and arbor, at the same time extending forward and upward to take a bearing upon the work arbor and thus greatly stiffen the job for the cutting operation.

The cutter itself is tapered to conform to the taper required on the gun barrel, and only one cut is necessary to produce the correct contour. The rotating head is revolved each time to the exact point required, by means of the adjustable stop *B*. The fixture enables this portion of

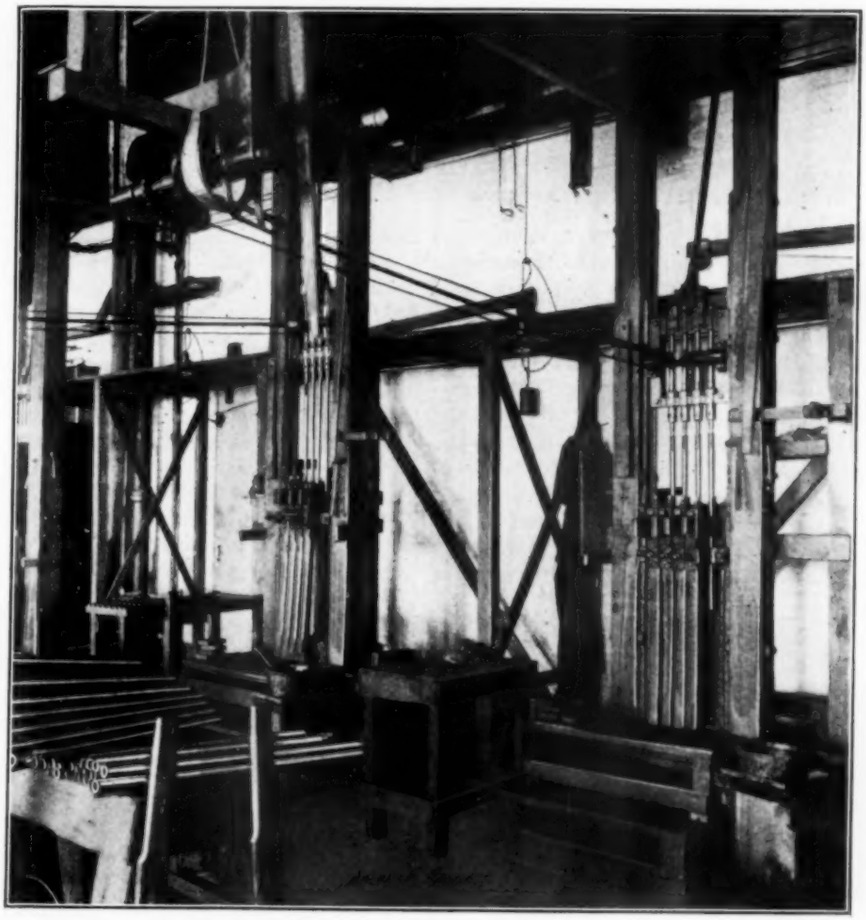


Fig. 6. Barrel-polishing Machines

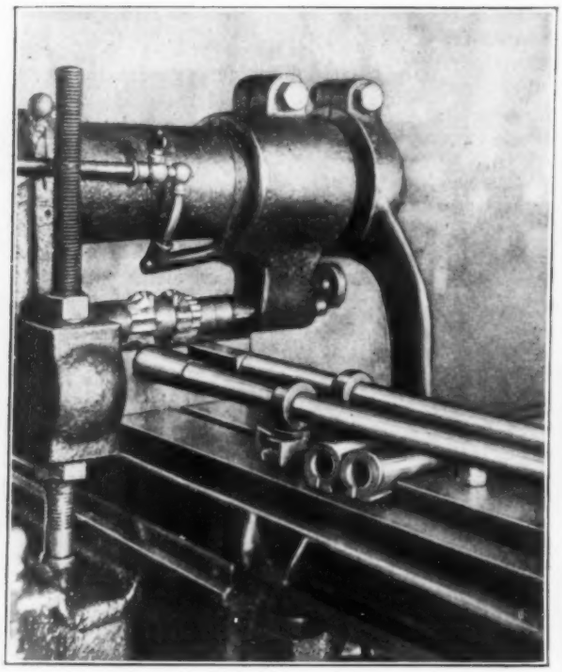


FIG. 7. MILLING DOVETAIL POCKET FOR LUG IN DOUBLE GUN BARRELS

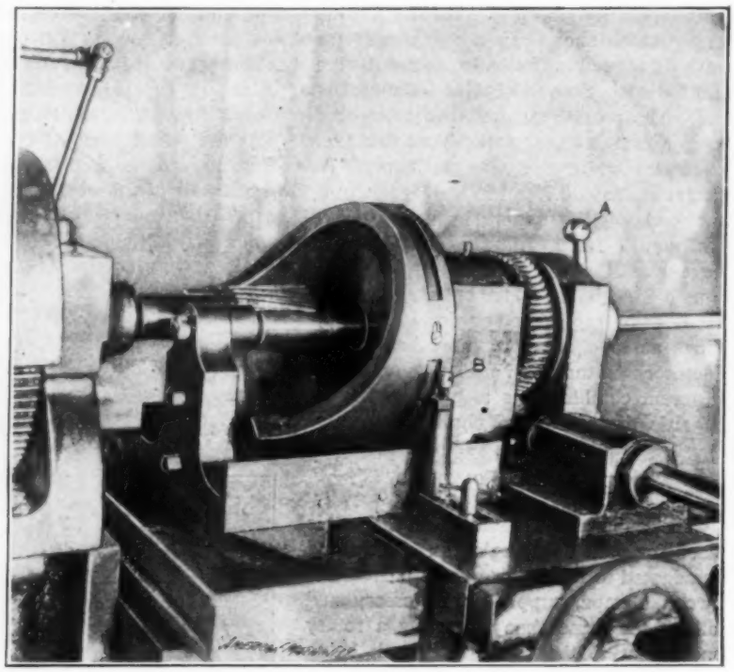


FIG. 8. ROTARY MILLING OPERATION ON BREECH END OF GUN BARREL

the barrel to be finished in considerably less than one minute.

A SOLDERING OPERATION

After the brazing in of the lug, the ribs at top and bottom of the barrels must be soldered in place, also the loop for the "forend" must be soldered in position. The two barrels are put together in the department, Fig. 9, after they have been "tinned" by dipping in a small deep pot kept hot in a special furnace. Here a number of distance pieces are placed between the barrels after one rib is slipped into place and prior to placing the other; then the barrels are wound with wire at several points along their length, the distance blocks and the wires holding the barrels and ribs firmly together.

Now, following the wiring process, the soldering operation is accomplished. To heat the work, the operator places several special mandrels or plugs in the furnace and after warming a pair of barrels in the fire, and getting the mandrels red hot, the work is placed in a fixture on the bench and a pair of the red-hot mandrels slipped in one end, thus heating the work sufficiently to cause the solder applied in stick form along the edge of the ribs to flow freely. Of course, the barrels are thoroughly cleaned before tinning and brushed with soldering acid, and when ready for soldering, a liberal quantity of resin is sprinkled along the work. After soldering about one-half the length, another pair of hot mandrels is slipped into the other end of the barrels and the soldering operation completed. The outside of the work is cleaned of superfluous solder and resin by sand blasting.

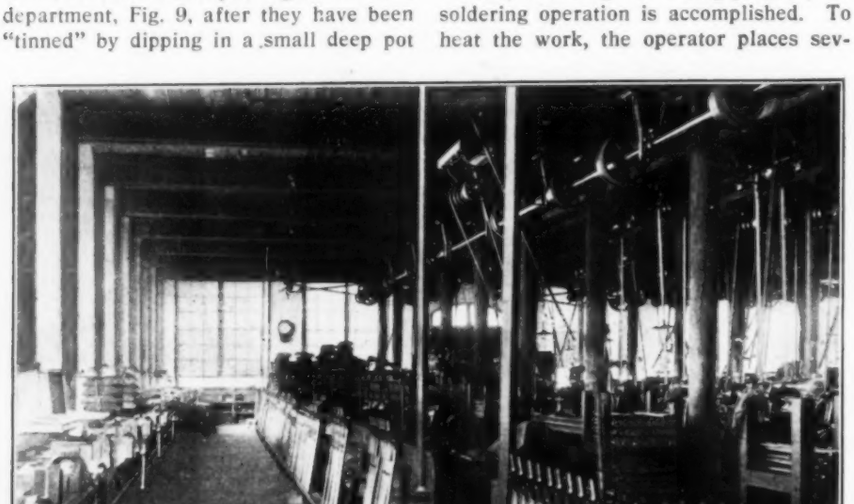


FIG. 9. VIEW IN DOUBLE-GUN FITTING DEPARTMENT

MILLING LUGS AND TOP RIBS

Some further milling operations which are performed after the barrels are assembled in pairs are illustrated by Figs. 10, 11 and 12. The first of these shows the method of straddle milling the lugs and at the same time surfacing the bottom of the breech end of the barrels to form a perfect seat, for bearing on the gun frame, this surface being called the "water table." The work is held in a conveniently manipulated fixture and supported by a device which obviates all possibility of springing during the milling cut. Fig. 11 shows the method of cross milling the ends of the lug by which the barrels are mounted on the frame or receiver.

A gang-milling operation is shown in Fig. 12 where four pairs of barrels are mounted on a fixture on the Brown &

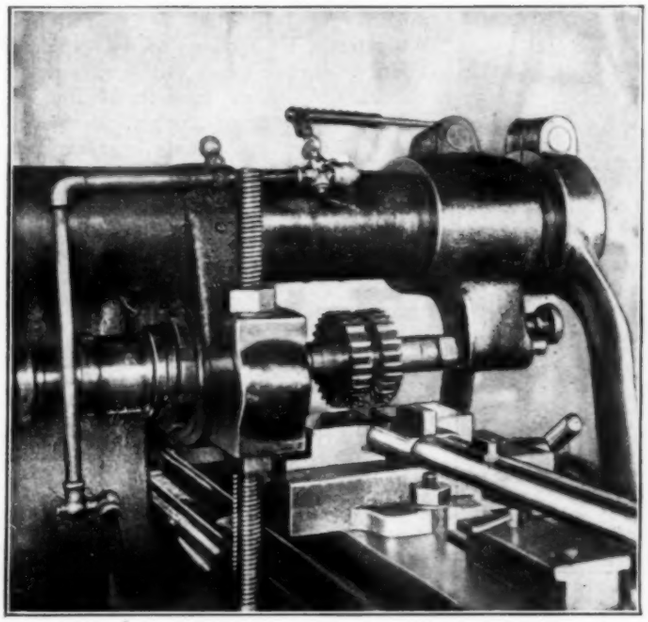


FIG. 10. MILLING LUG AND WATER-TABLE ON DOUBLE-GUN BARRELS

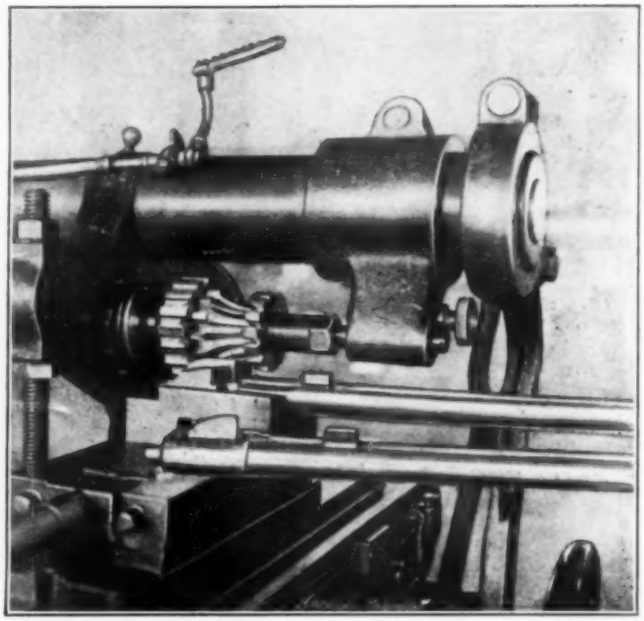


FIG. 11. FORM MILLING LUG ON DOUBLE-GUN BARRELS

Sharpe milling machine, and held without chance of distortion while the top ribs are milled flat and true by the four cutters shown on the arbor. The operation of "matting" these ribs is accomplished in the machine illustrated by Fig. 13.

THE MATTING MACHINE

This machine is arranged for automatically matting the rib, breaking up the flat surface sufficiently to prevent the reflection of light and the consequent glare in the eyes when sighting along the gun. The machine is adapted to carry three narrow, flat knives, or chisels, and operates somewhat upon the principle of a file-cutting machine. The three flat cutting tools, located at *C*, are lifted by means of cams *D* resembling ratchet wheels and driven back against the work by the stiff flat springs acting upon their upper ends. The force of the blow may be regulated by applying more or less pressure upon the springs, and the pitch is varied by change gears at *E*, acting upon the feed screw which traverses the carriage. Ordinarily the pitch is about 40 per inch, and the cut 0.01 inch deep. The ribs matted in this machine are quite commonly cut with a combination of three rows of straight lines, the central row being at right angles to the rib, while the row at either side is oblique, as indicated in the halftone, Fig. 1. The ribs can be so formed and matted that the two outer or side mats are raised and the center mat depressed sufficiently to form a matted valley down the rib for guiding the eye to a quick sight.

It is obvious that if the barrels carrying the rib being matted rested upon a perfectly rigid support, the action of the cutting tool upon the rib would by a peening process tend to elongate the upper surface and cause deformation of the work. To obviate this, the barrels, while being operated upon, rest upon soft-wood blocks, which are placed at intervals along their length, and give a cushioning effect tending to offset any peening tendency of the cutting tool.

MAINTENANCE OF THE MATTING TOOLS

This machine is ordinarily operated at about 600 blows per minute. In order that the best results shall be obtained with the cutters it is essential that they be ground at the proper angles, and that the impact upon the work shall be along a line at a suitable angle to the surface of the rib. To facilitate the grinding operations, a special fixture has been devised upon which the tools are held to give proper rake and clearance, at the same time locating the cutter from a shoulder formed on its edge, by which it is lifted preparatory to springing back to the cut. This means, then, that the cutter is lifted exactly to a predetermined distance, and that all the cutters shall strike properly with the same amount of drop.

Of course, the cutters may be made of other shapes than straight lines, combining, say, two outer rows of curved lines with a curved or straight row between, or other combinations can be produced. The cutters are interchangeable and as

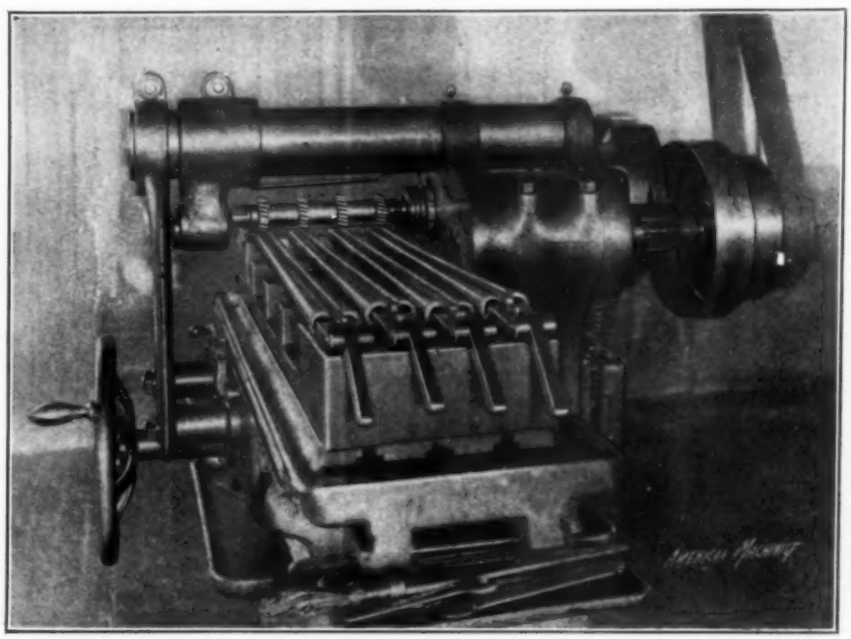


FIG. 12. MILLING TOP RIBS

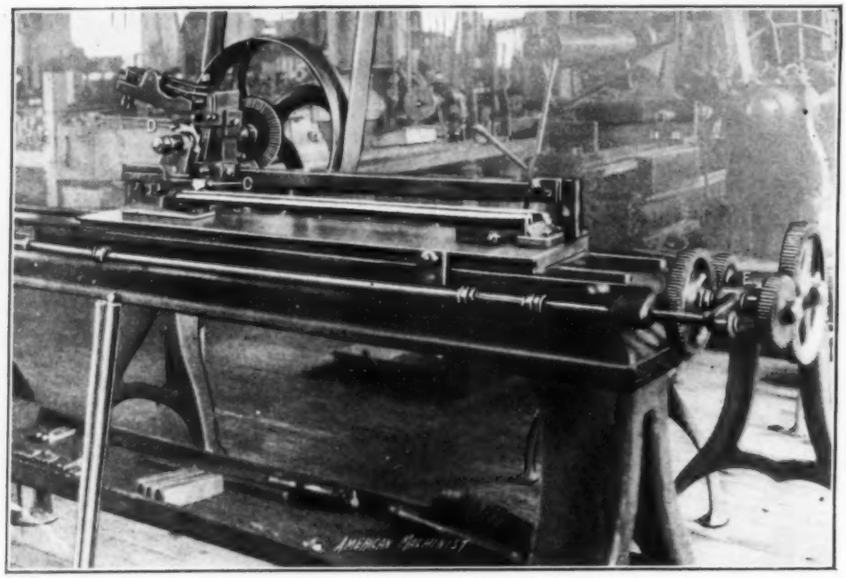


FIG. 13. AUTOMATIC MATTING MACHINE

indicated above are all ground to definite length from the heel which bears upon the lifting cam or ratchet.

The finish boring or reaming operation on the pair of barrels for the double gun is accomplished in the machine shown in Fig. 4, which has already been referred to in connection with the finishing of single barrels. The barrels are ready then to be draw filed to prepare the surface for "browning."

THE BROWNING ROOM

The process of browning gun barrels, which, by the way, is called "black browning," now that the surface given the metal is a positive black, is carried on in the department represented in Figs. 14 and 15. There is not much apparatus to be shown in this connection; however, some idea of the method of handling the work can be given in a few words.

Upon a bench at the side of the room there are a few hundred wooden plugs which are inserted in the ends of the barrels to facilitate handling them without touching the metal itself. The barrels, as they come to this department, are thoroughly cleansed of all grease, then treated with a solution of lime and washed in hot water, after which the browning material is applied with a sponge.

There are different formulas for this mixture, one of which is as follows: Aqua fortis, 1½ ounces; sweet spirits of niter, ½ ounce; sweet spirits of wine, 1 ounce; tincture of muriate of iron, 1 ounce; sulphate of copper, 1 ounce; water, 30 ounces. Add 3 grains per ounce of corrosive sublimate or possibly less for lower grades of barrels. Let stand for at least 24 hours before using.

SUCCESSIVE APPLICATIONS ON THE BARREL SURFACE

After this mixture has carried on its rusting or etching operation for, say, 24 hours, the surface is carded off with a file card or wire brush and given a second coat of the browning mixture, which, as with the previous coating, is allowed to remain for perhaps another 24 hours, this being followed by the carding of the surface and the work then being immersed for some time in water and then cooled off. A third coat of the browning mixture is then applied, and after 24 hours the work is placed in boiling water containing logwood and then in a hot bath having a small percentage of alum to set the color. Again the barrel is carded, then finally placed in the boiling liquid, rubbed off with a sponge when removed from the tank and wiped dry.

In this department the barrels, while undergoing the action of the browning material, are kept in a closed room, free from dust and under an even temperature. While the preceding paragraph gives the time during which each coat remains on the barrel as 24 hours, this time actually is varied somewhat to suit conditions, and here the individual judgment of the men in charge of this work must be relied upon for the results de-

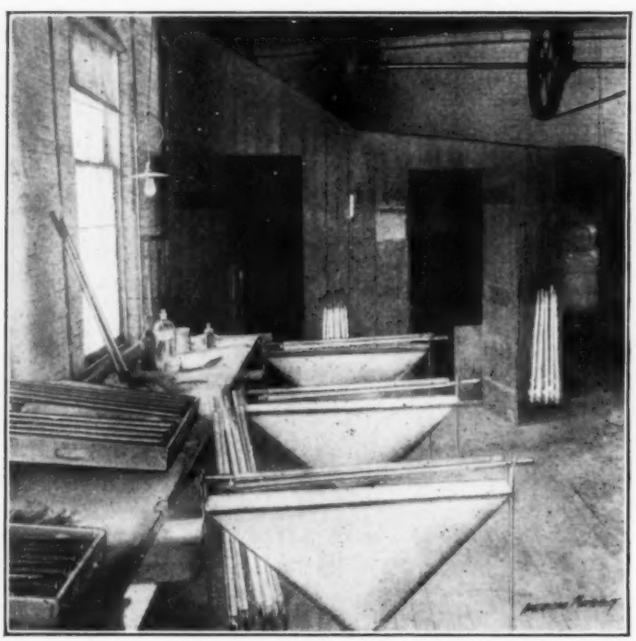


FIG. 14

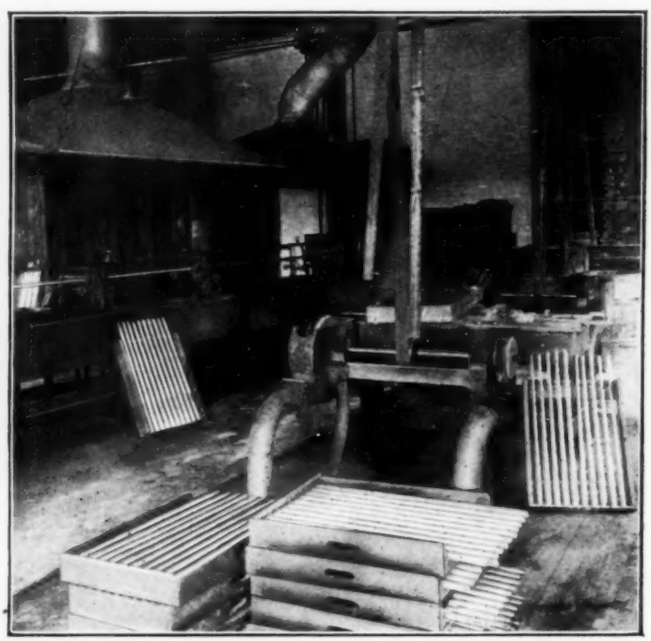


FIG. 15

THE BROWNING ROOM

sired. Such conditions as variations in humidity, temperatures, etc., have a bearing upon the length of time which a barrel should be treated to obtain the finish required.

It will be seen from the views, Figs. 14 and 15, that the tanks in this department are provided with suitable hoods, and exhaust apparatus carries away the vapors from the baths and also the powdered material which is carded from the barrels while they are supported over the sheet-metal receivers shown in Fig. 14.

Handling Twist Barrels

In the case of twist or laminated barrels, where the pattern due to the twist is to be brought out on the surface, the action of the browning mixture gives a black and silvery-white appearance In outlining the twisted figure, the steel being blackened by the etching process and oxidation and the iron cleaning up a silvery white. While the browning of such barrels differs slightly in certain details from the procedure in connection with what are commonly called "black barrels," owing to their plain black surface, in general the treatment of the two classes of work in the browning department is quite similar.

An Economical Belt Drive

Editorial Correspondence

A belt drive which was so carefully planned and installed that it has run eleven years without costing a dollar for repairs.

One of the interesting features of the shops of the F. E. Reed Company, of Worcester, Mass., is the system of belt drives which were installed nearly 11 years ago by Nathaniel Hill, of Lowell, Mass. Starting in the engine room with the 136-horsepower Brown engine with its 12-foot flywheel running 83 revolutions per minute, the whole power of the shop is transmitted by two comparatively narrow leather belts, one being 5 and the other 7 inches wide, being what is known as light, double leather belt.

Fig. 1 shows the engine flywheel and the idler above it which forces the belt to make contact with about ¾ of the flywheel's circumference. This is for the narrow belt, the idler for the wide belt is shown in Fig. 2, where the belt also has a large arc of contact and goes around the idler shown.

Compact Dynamo Drive

Fig. 3 shows a very short coupled belt connection in the same engine room where space is extremely limited and which was necessary to drive the dynamo for furnishing light and current for the shop. This is taken from a short jack shaft carrying the large pulley shown at the extreme left of the picture, the belt making about ¾ of a turn around it and running over idlers so as to have an equally large contact with the dynamo pulley. One idler is adjustable by the

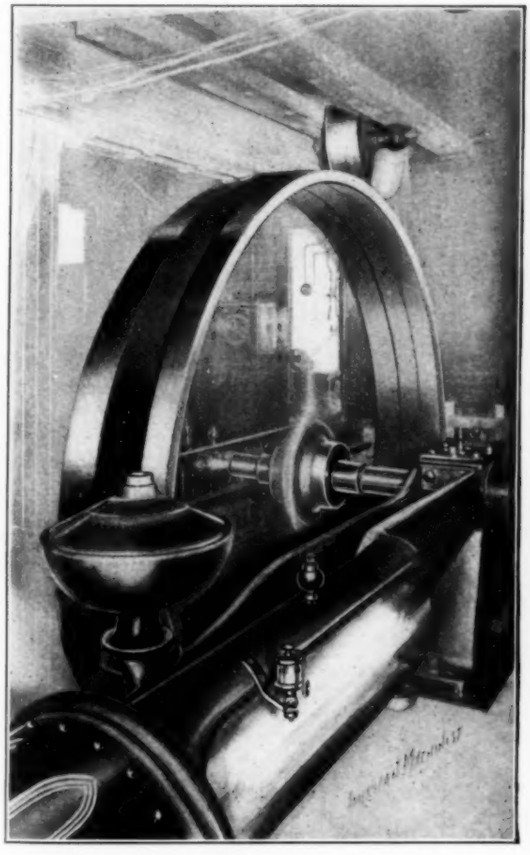
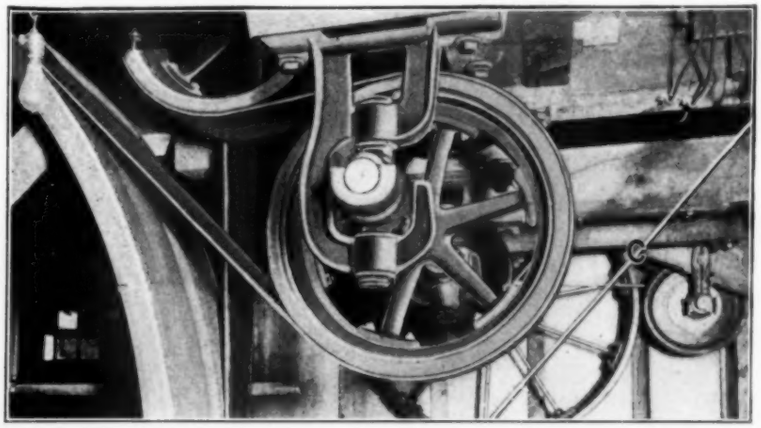


Fig. 1. Engine Room with Two Belts on the Flywheel



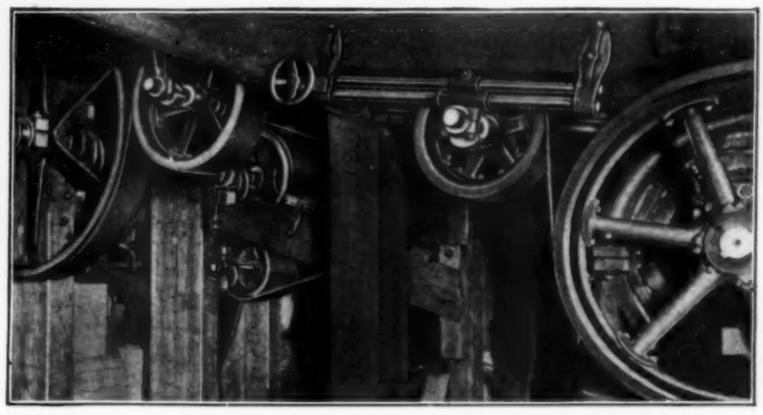


Fig. 2. The Idler on the Wide Belt
Fig. 3. Belting from Jack Shaft to Dynamo

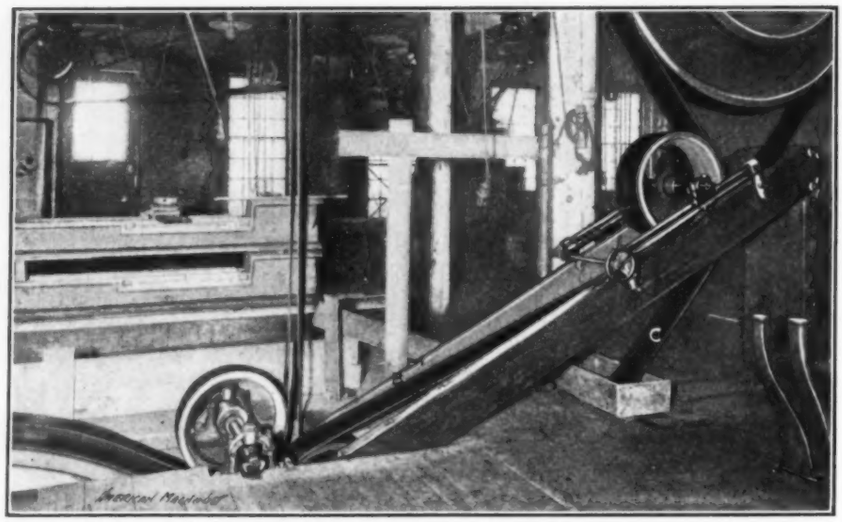


FIG. 4. WIDE BELT DRIVE THROUGH FIRST FLOOR

screw arrangement shown so that the proper belt tension can be secured at all times. This not only allows excellent belt contact but also keeps the under side of the belt out of the way between the two timbers shown over the idler pulley.

GETTING POWER UPSTAIRS

The view in Fig. 4 was taken before the flywheel was boxed in and shows how the narrow belt goes straight up to the next floor while the wide belt *B*, after going over the upper idler in Fig. 2, runs off at an angle and drives the large pulley shown, 6 feet 8 inches in diameter, in the upper right-hand corner, the return being down through the floor and shown at *C* in Fig. 4.

Fig. 5 shows the narrow belt after it passes through the floor above and gives a good idea of the large size driving pulleys used in the line shaft. This pulley is 7 feet 8 inches in diameter. Here again, the extremely large belt contact will be noticed and the adjustment of the idler for varying belt conditions.

In Fig. 6 is an interesting quarter-turn drive where power is transmitted down from one of the line shafts to a special department below. The angle of the upright timber supporting the idlers and the way in which they act as guards for the belt is clearly shown. There is another large pulley directly below the floor, the lower idler maintaining the same large contact as on the upper pulley.

AN INTERESTING ARRANGEMENT

Fig. 7 shows an extremely interesting and apparently complicated arrangement which transmits power from one shaft to the other, and also to the intermediate shaft which is used for a special purpose. Beginning with the right-hand shaft and following the belt in the direction of the arrow we find it goes around the large pulley up over idler *A*, around idler *B*, straight to the left to idler *C*, around this to the under side of the large pulley *D* on the intermediate shaft, and over this to the pulley on the shaft at the left. While this seems to be rather complicated it will be noticed that the large contact is secured on all three of the driving pulleys, which enables them to transmit the desired power.

Fig. 8 is a very close connected quarter turned drive which requires little explanation. The power coming up from below at the extreme left and being transmitted to the shaft at right angles, through the large pulley *A*, over the idlers *B* and *C* to the other pulley *D*. It will be noticed that in this case both sides of the belt are used, in the case of the idler *D*.

INTERESTING BELTING FIGURES

At engine speeds quoted these belts give a belt speed of about 3100 feet per minute, and dividing 136 horsepower by 12, the combined widths of the belts, we have 11⅓ horsepower per inch of width. According to these figures, they are securing a horsepower at a belt speed of a little less than 280 feet per minute per inch of width which is considerably

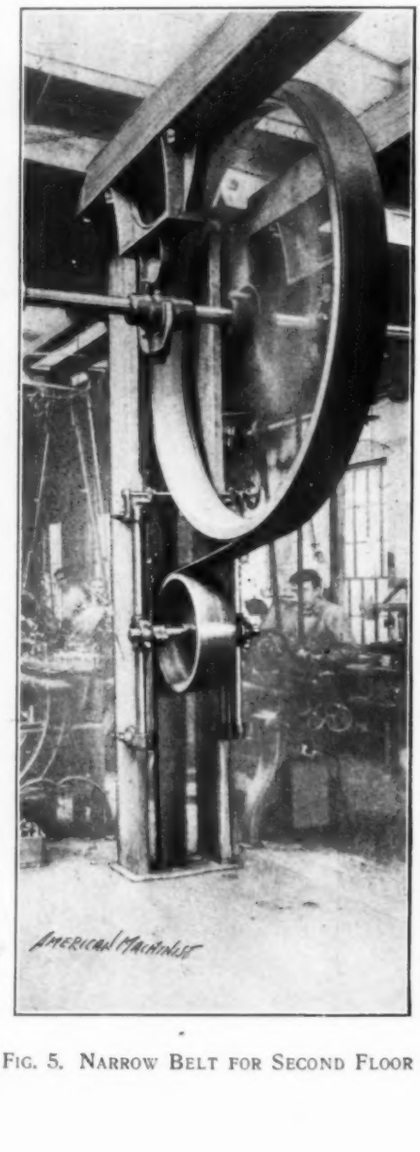


FIG. 5. NARROW BELT FOR SECOND FLOOR

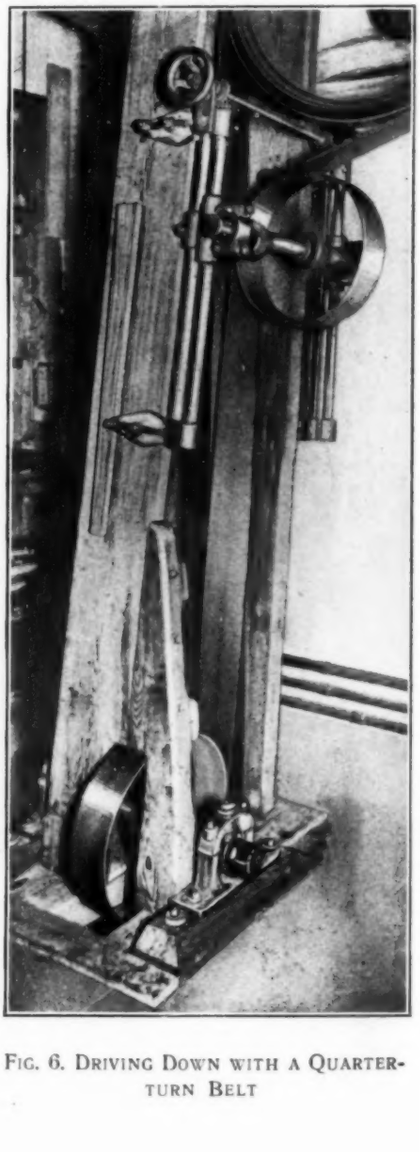


FIG. 6. DRIVING DOWN WITH A QUARTER-TURN BELT

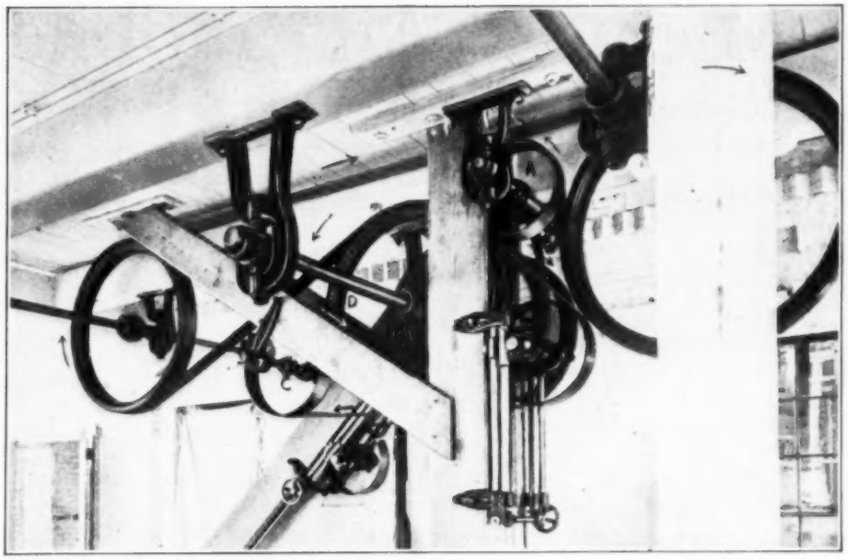


FIG. 7. CLOSE ARRANGEMENT OF PULLEY TO SECURE GOOD CONTACT

lower than is usually considered as a safe allowance.

These belts can all be run forward or backward without running off the pulleys,

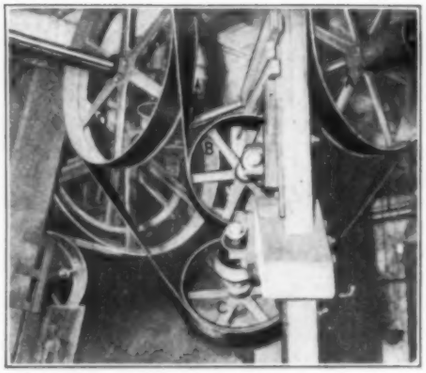


FIG. 8. REVERSIBLE QUARTER TURN

all stretch being taken care of by the screw-adjusted idlers shown. This is an extremely interesting installation in many ways, and the fact that it has been in constant operation for years with the same belt and without the expense of any kind except that required for ordinary care, speaks very highly for its economy.

Finishing with the Rotary File

By Fred Cedarleaf

A handy way of finishing punches and a pointer on the allowance to be made between punch and die that results in good work

This die-making kink, though not new, may help some mechanics that read this. The idea is to use a rotary file for removing the stock from the blanking punch for clearance when an even break is required on the finished steel blank.

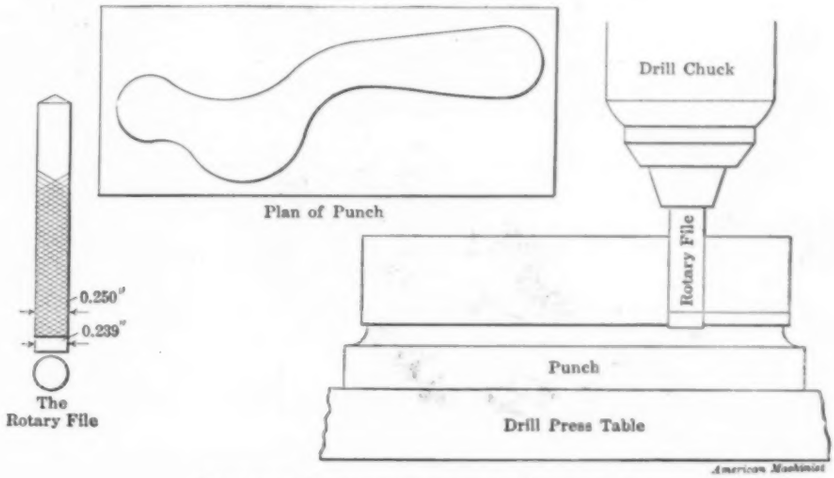
The general rule for blanking steel is to make the punch 6 per cent. of the thickness of the stock to be punched, smaller on each side than the die. Most diemakers, after shearing the punch through the die, remove the rest of the stock by filing by hand, which, at its best is nothing but pure guesswork and generally calls for a lot of oil-stoning after the punch is hardened. By using the rotary file shown in the sketch this stock can be removed faster and easier and at the same time evenly all around, assuring an even break in the finished blank.

For example we have a die and punch to make like the sketch. The die is first laid out, finished to size, hardened and stoned to fit the templet. The punch is then machined within a shade of the line, sheared into the die about 1/16 inch and then filed within a couple of thousandths of the sheared portion. It is then sheared through the die and the clearance figured.

Say we are to punch 3/32-inch sheet steel. Six per cent. of 0.093 inch = 0.0055, or the amount to be removed from each side of the punch. We next take a rotary file ¼ or ⅜ inch diameter and hold it in a collet in the bench-lathe. After making it run pretty true we use the grinding attachment and grind about ⅛ inch at the end of the file as much smaller on a side as there is stock to be removed from the punch which in this case is 0.0055 inch. If the file measured 0.250 inch we would grind the end down to 0.239 inch diameter. The file is then held in the drill press, and run at fast speed, the punch being held on the table and forced into the file which will cut until the ground surface touches the surface of the work. After going all around the punch a ridge is left on the bottom which can be easily removed by bringing the file down ⅛ inch further and working this ridge down flush with the rest of the punch.

A set of files ground at the end to suit the standard thicknesses of stock is a handy addition to any mechanic's tool kit.

I may mention that a good way to lay off the punch is to tin the face of it and then float a thin film of solder on it. The punch is then squeezed against the face of the die, leaving an accurate imprint on the soft solder film, which is easily followed. This is more accurate than scribing through the die.



FINISHING PUNCHES WITH THE ROTARY FILE

Building the Maxwell Automobile

By Snowden B. Redfield

Maxwell automobile construction requires special tools and fixtures to secure alinement of the many bearings in the combination crank and gear case.

Milling of the top surface provides location vertically and for facing all the bearings. The end surfaces of these bearings give location endways for all further operations.

Flywheels and shafts are balanced separately, assembled, and then the rim of wheel is ground, using a standard crank case as the supporting fixture for the shaft.

Owing to the fact that in the construction adopted for the Maxwell automobiles, the transmission gear case is integral with the crank case of the engine, there are a number of interesting operations and fixtures used in connection with the finishing of these parts. In Fig. 1 the general shape of the casting, which is of aluminum, may be seen.

In this illustration the portion *A* forms the crank case of the engine and in its top may be seen the four round openings upon which the engine cylinders are set. These openings are connected by a straight, longitudinal opening through the casting. The portion marked *B* forms the transmission gear case. In this portion of the casting, *C* is the thrust bearing of the main shaft, leading back to the differential and *D* is the bearing of the countershaft which carries the change gears. At *E* may be seen the inside bearing for this countershaft, corresponding to the bearing *D*. There is also another shaft lower down, which does not show, but which carries the reversing gear. At *F* are the two openings for the cam shafts of the engine and the flaring pockets in the casting at these points are to take the large cam-shaft gears.

Machining the Top Surface

As will be seen, for the first operation of machining the top, the casting is held in a jig upon the table of a planer type miller and after leveling up, is run once through, with the type of cutter shown. The flat disk cutter has inserted teeth and mills off the top, flat surface, while the end mill, extending down through the longitudinal opening in the casting, cleans off the sides of this opening. There is but the one operation of rough milling, as this is considered sufficient for this part of the work. The cylinders are permanently located by the circular openings which are machined later.

When the top of the crank case has been machined, an end mill is put into the spindle and the top of the transmission case *B* is cleaned off. This finishes the operation on this machine.

Milling Ends of Six Bearings at a Time

In Fig. 2 is shown a special milling machine made from a lathe. The 13 milling cutters mounted upon the spindle, serve to finish the ends of the main bearings of the engine and transmission, and it is from these bearing ends and the top surface of the crank case, that the other operations are located. The ends of the bearings are milled square by bolting the milled surface of the top of the crank case against the face of the upright plate shown behind the milling spindle in Fig. 2.

In Fig. 3 is shown the next operation; that of boring, or reaming out the four openings for the engine cylinders, which, unlike usual construction, are recessed into the crank case itself. As will be seen, the casting is held in a fixture and its location is obtained by the square bar running through the casting, which also has a stop piece at one end to butt against the faced end of one of the main bearings. In this position the four cutters are exactly central over the centers of the four crankpin locations.

After the four openings have been finished, these openings form the locations for a drilling jig, to drill the bolt holes in the top of the crank case. This operation is illustrated in Fig. 4, where a 16-spindle multiple drill is used to drill and ream these holes. The crank case casting is, of course, held in a fixture which provides a three-point suspension.

Machining Bearings for Counter and Reverse Shafts

This being done, the next operation is to bore out the main bearings. The bearing boxes are first babbitted and then bored out with a long boring bar and shells, carrying cutters. Following this it is necessary to bore and ream the bearings for the countershaft and reversing shaft. This is done as in Fig. 5, where it will be seen that the casting is located under two yokes on a horizontal boring

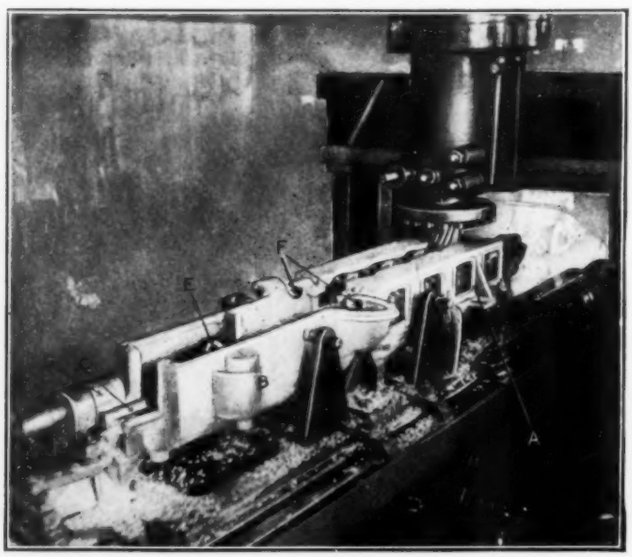


Fig. 1. Milling Top of Crank Case and Longitudinal Opening

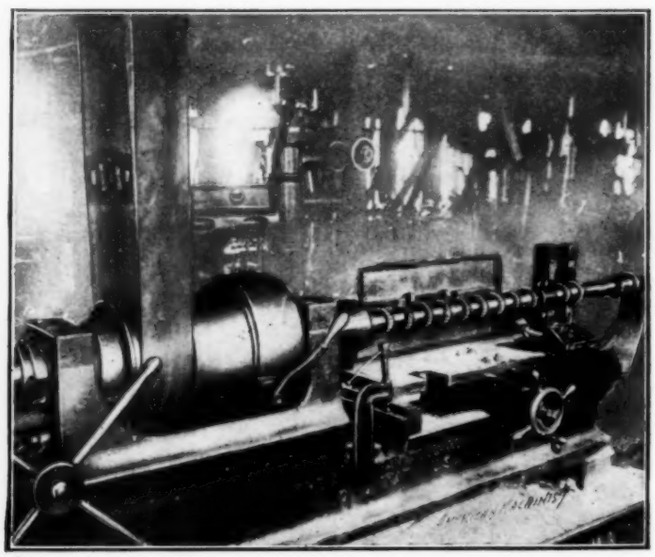


Fig. 2. Milling Machine with 13 Cutters for Facing Ends of Bearings

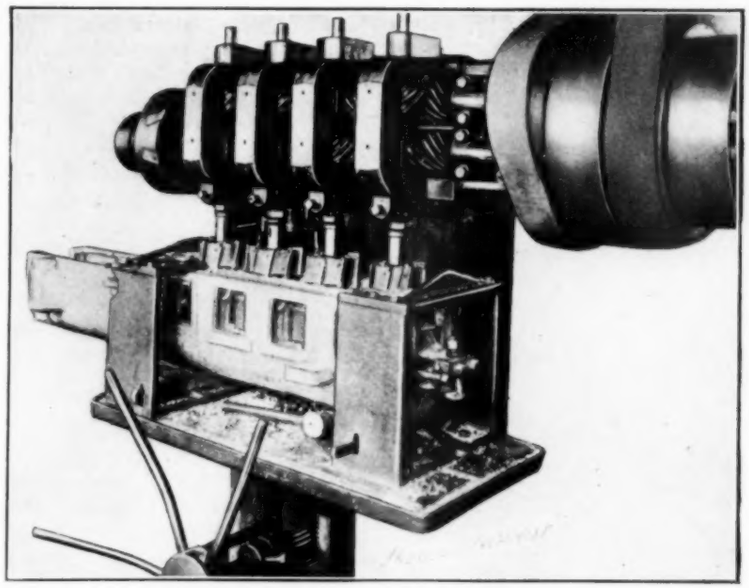


FIG. 3. BORING OPENINGS FOR ENGINE CYLINDERS

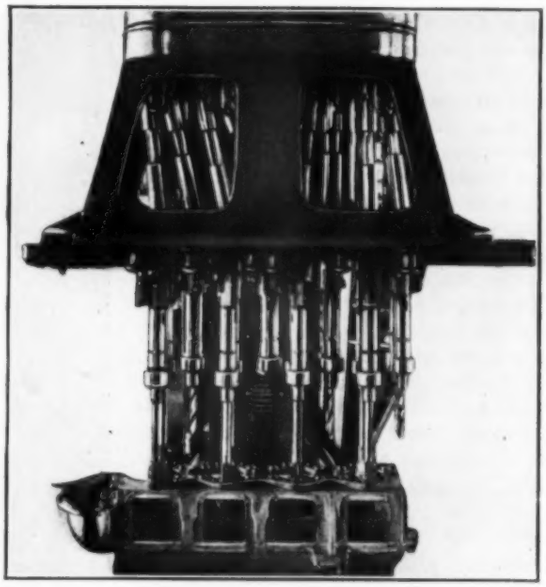


FIG. 4. SIXTEEN-SPINDLE DRILL TO DRILL AND REAM HOLES IN CRANK CASE

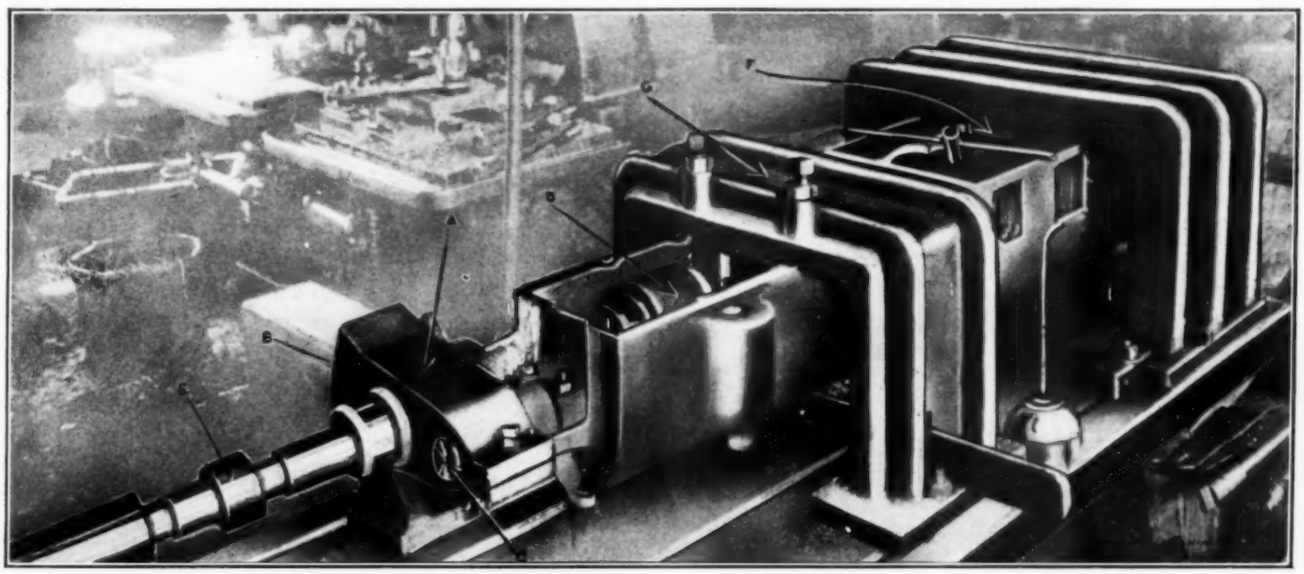


FIG. 5. BORING, REAMING AND FACING COUNTERSHAFT BEARINGS

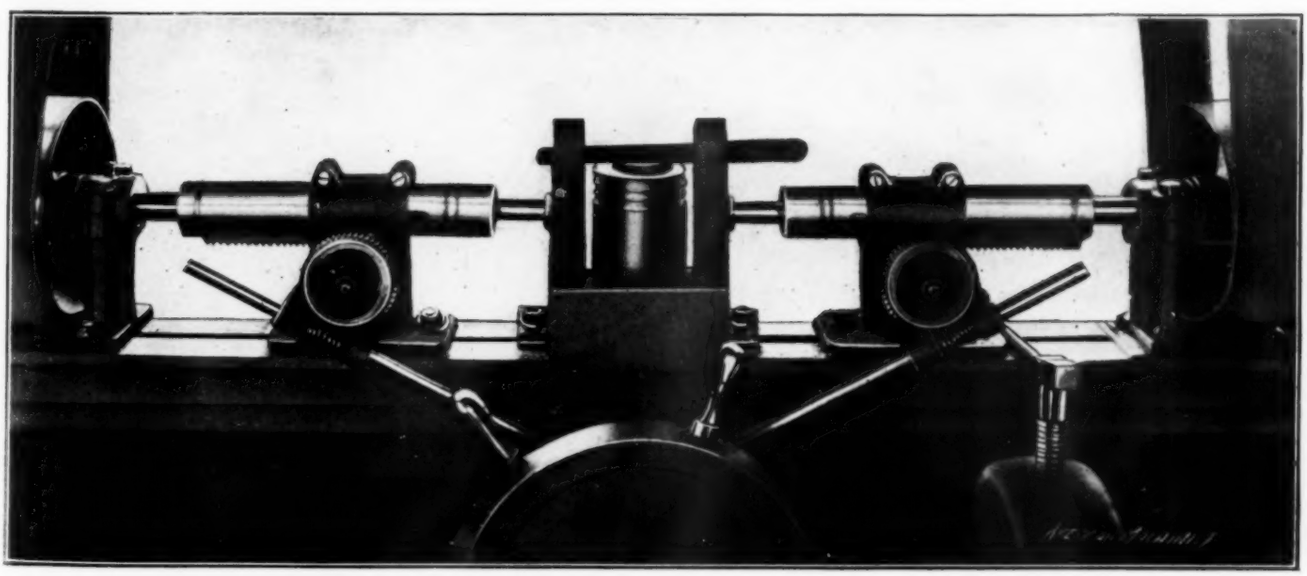


FIG. 6. DRILLING AND REAMING WRIST PIN HOLES FROM BOTH SIDES

machine. In this machine the yoke *F* has a projection extending down into the machined opening, along the top of the crank case and the yoke *G* is a little bit high, so that when the casting is drawn up against the top of *F*, by means of the wedge underneath, the casting does not touch the yoke *G*. This is to provide against springing the casting. After it has been brought rigidly against the yoke *F*, the two screws in the top of *G* are brought down to touch against the casting and the wedge in the bottom of *G* is then driven in, to hold the whole piece rigidly. The projection on *F* is long enough to extend a considerable distance along the straight opening at the top of the crank case, so as to bring the casting in line with the cutter spindle.

In order to locate the bearings of the countershaft, the fixtures *A* and *D* are used. It will be remembered that the main bearings of both the crank case and transmission case, have been faced and then bored out, in line, with the one boring bar and consequently these bearings, both in their bore and on their end faces, may be used for location. The fixture *A* swivels about a mandrel *C*, put through the end thrust bearing of the transmission case and also held in the last main bearing of the engine below the yoke *G*. This mandrel is clamped solid in the bearing, and the radius pieces *A* and *D* are swung from this mandrel. The mandrel *C* is provided with a keyway, so that the guiding holes in *A* and *D* come directly opposite each other, to guide the boring and reaming tools through both countershaft bearings.

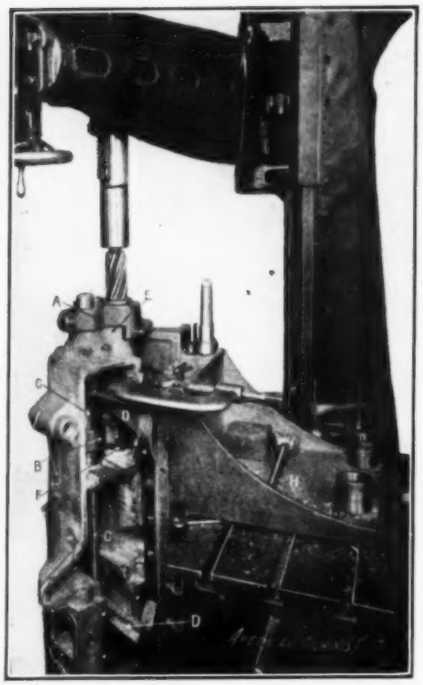


FIG. 7. DOING THE WORK OF FIG. 5 ON A RADIAL DRILLING MACHINE

Vertical location of the countershaft is secured by the part *B*, which is bolted down to the table of the boring machine. The part *A* slides in an arc in *B*, and when located according to the boss on the casting, as to its angular position, the parts *A* and *B* are held together by a suitable clamping bolt. The spindle is guided in the brackets *A* and *D* by bushings, while inserted boring tools bore out both the inside and outside bearings, at the same time.

When both these bearings have been bored, the spindle is withdrawn, without changing the position of the jigs *A* and *D*, however, and reamers are put in, which ream both the bearings at the same time. This being done, another bar is put through, having facing tools, which face off the inside ends of the two countershaft bearings, the facings being located by marks on the spindle of the boring machine. Gages are also provided for locating these facings with reference to the facings of the main bearings in the casting.

The piece *A* also has a third opening through it, for boring out the bearings of the reverse shaft. These bearings are drilled in the casting, as there is no cored hole, the drill being guided by the jig *A*. The hole is afterward reamed with the same guide, and facing cutters are put in to face the inside ends of these bearings.

USING THE RADIAL DRILL PRESS

In Fig. 7 is illustrated another method of doing this same work, using a radial drill press. Here a bar *C* is held on the two arms *D D*, bolted to the angle piece *H*. The bar *C* is clamped in the main bearings of the casting and the radial arms *A* and *D* are put on, held in line by means of a keyway in *C*, just as in Fig. 5. The fluted end mill is then run through the top bearing and this is followed by a boring bar, to bore out the lower, or inside bearing; then by facing tools as before. The operation on this machine, however, is not so simple as on the machine illustrated in Fig. 5, for, in the case of the radial drill press, each bearing is machined separately, while in the case of Fig. 5 the operations on both the bearings are done at the same time. In Fig. 7 the lower or inside bearing is shown at *F*.

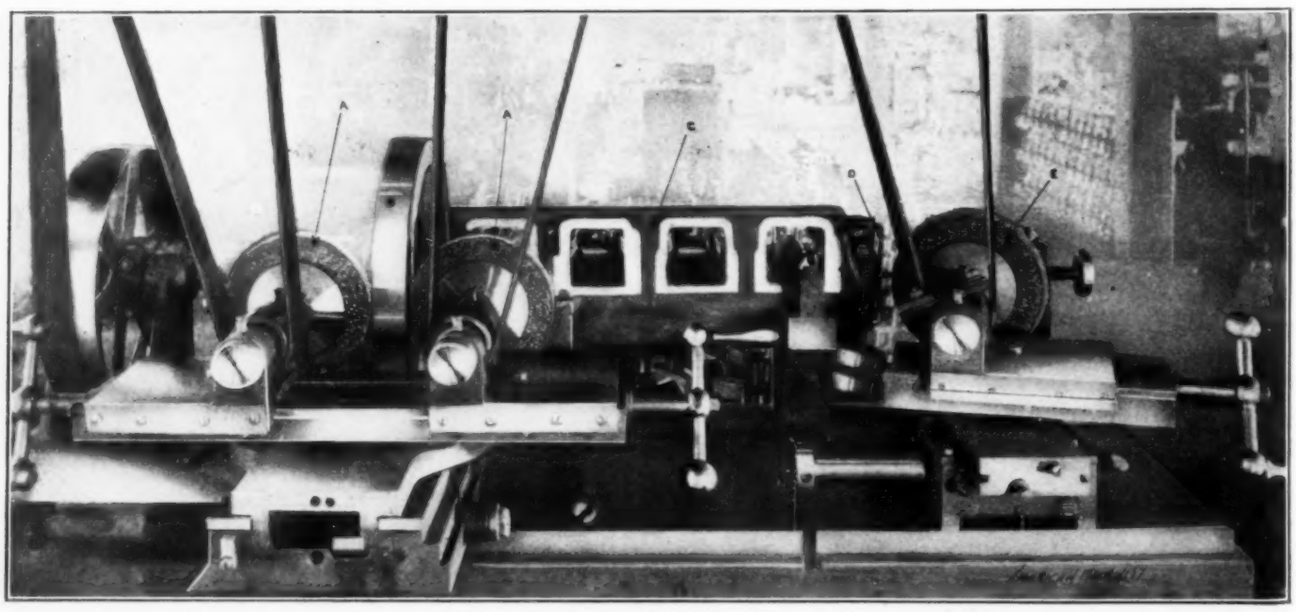


FIG. 8. GRINDING FLYWHEEL ON ITS OWN SHAFT, WHILE HELD IN A STANDARD CRANK CASE

An interesting operation is shown in Fig. 6. This is the drilling and reaming of the wrist-pin holes in the piston. As seen, this is done from both sides at the same time, by means of the special, double quill, drilling machine there shown. By means of the hand-wheel in the foreground, both of the drills or ream-

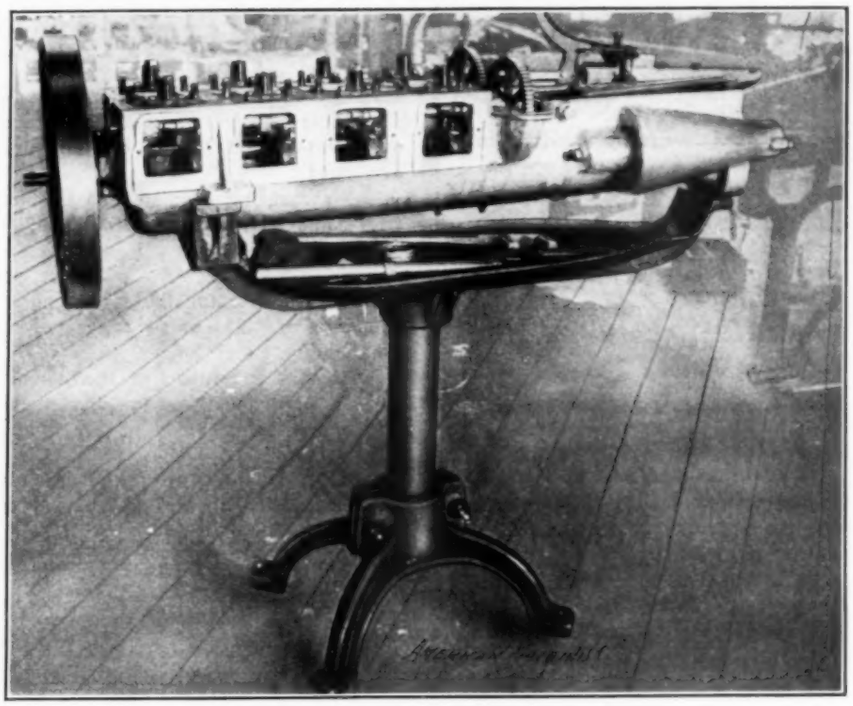


FIG. 9. NEAT ASSEMBLING STAND

ers, are fed in at equal speeds and consequently the work is done twice as fast as if done from one side only.

GRINDING FLYWHEEL RIM AFTER MOUNTING ON ITS SHAFT

Fig. 8 is probably the most interesting of all the operations shown. Here the flywheel *B* is ground perfectly true, after having been mounted on its own crankshaft. The casting *C* is a finished crank case, which has been adapted to this special grinding machine and serves only to hold the work. Through the windows in this casting may be seen the crankshaft upon which the wheel *B* is mounted, practically ready to go into the engine for which it is designed. By grinding the wheel in place on its own shaft and in a standard crank case with all its bearings, it is certain to be in true alinement. The two grinders *A A* are fed in by the handwheels to grind the side surfaces and also the periphery. While this is going on, the grinding wheel *E* is grinding off the surface of the clutch yoke *D*. Before this grinding, both the shaft and wheel are tested and balanced, separately, so that they are each in balance before assembling. In this way, further grinding of the wheel does not unbalance the combination of the two.

In most well organized automobile shops, some special tables or benches are provided to hold the partly assembled pieces. In Fig. 9 is shown a very neat form of table, giving a three-point suspension to the engine, during assembling. By the three-point suspension the engines are held practically as they are in the finished automobile and the complete surface of the engine is free to get at. Moreover the cup-shaped portion of the stand underneath the engine, forms a handy receptacle for wrenches, files, chisels, etc. The tables themselves are bolted down to the floor, so that there is no possibility of being upset.

In Fig. 10 there are 24 oil pumps being run by suitable shafts, to work them in. All of these pumps are actually pumping oil and in this way they can be adjusted and inspected for positive operation. These pumps are run for a number of hours, to insure that all parts run well and the pumping is as it should be.

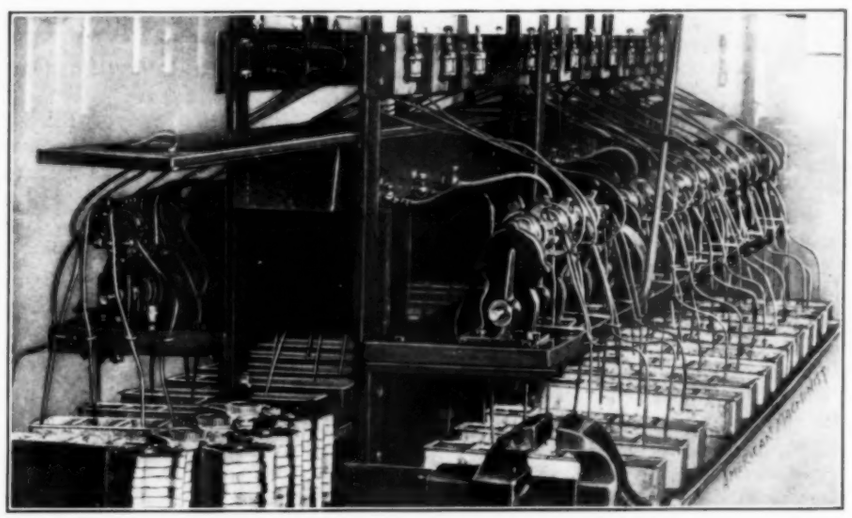


FIG. 10. RUNNING 24 OIL PUMPS AT A TIME TO WORK THEM IN

Special Quotation System

BY RUSSELL

In practically all manufacturing plants there are more or less frequent requests received for prices on special goods, to meet the customer's individual requirements.

Such inquiries often involve considerable time and labor to estimate accurately material costs, labor costs, etc., and when the information is compiled and the quotation upon the special work made, there should be some simple system whereby the full information may be filed and be easily and quickly referred to.

The best method which has come to my attention is the one which I have adopted, and which works out very nicely. A loose-leaf binder is provided, to take the standard size letter sheet, 8½ x 11 inches, as well as the smaller size note sheets. An alphabetical index is used, and when a quotation is made, a carbon copy is filed in the binder. Thus when the order is received it is checked up with the quotation and the proper entry made in the order book.

The carbon copy also provided a means of easy reference, should a similar inquiry be received. When the order is completed and billed out, the carbon sheet is removed, and the proper record made in a permanent card-index file, made up particularly for special work. The quotation binder is simply used for matters which are pending; either after order has been received and work in progress, or in case offer is not accepted, the information is of value in making up other similar special estimates, etc.

Another use for aluminum has been found in combining it with gold to produce a metal that is said to possess a beautiful hue adaptable for wide use in the jewelry trade. The alloy is composed of about 78 per cent. gold and the aluminum seems to give just about enough different color to give a very artistic appearance.

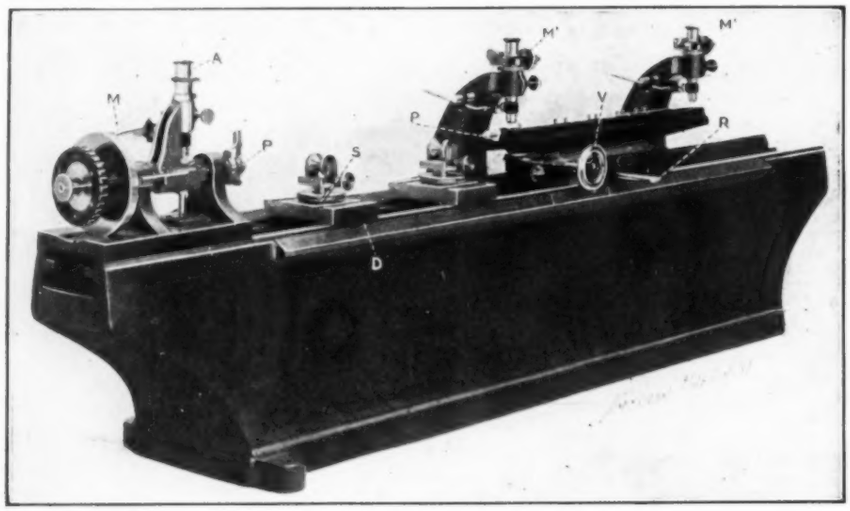
A New Swiss Measuring Machine

By Dr. Alfred Gradenwitz

A measuring machine designed so that the divided rule is located in the axis of the contact points on which the gage or product is to be placed, thus eliminating any inaccuracy due to deformation of bed

The latest type of measuring machine designed by the Société Genevoise pour la Construction d'Instruments de Physique et de Mécanique, Genèva, Switzerland, is based on the following principle:

It will readily be understood that in connection with machines destined for measuring considerable lengths, such as one, two and up to four meters, it is impossible in practice to keep a sufficient number of standardized gages distributed over such lengths, to allow copies to be prepared therefrom. In fact, such a store would entail quite prohibitory expenses. A machine designed for effecting measurements of any gage desired is, therefore, likely to afford a great advantage. The machine represented in the halftone enables the length of a gage to be accurately ascertained either by comparison with a gage of approximately equal length, or by direct comparison with the divided rule belonging to the machine.



SWISS MEASURING MACHINE

This divided rule which, in order to be protected against any variations in temperature due to the influence of the observer, is covered with an insulating sheathing, is shifted rapidly by loosening the screw *R* and moving the carriage by hand along the bed.

In order to effect a fine adjustment, the arresting screw *R* is tightened, after which a micrometrical movement is obtained by turning the handwheel *V*. Fractions of a millimeter are read either by means of the eyepiece micrometer *M'*, or the large micrometer *M* fixed at the left-hand end of the bed. This micrometer *M* carries a drum so divided that each division corresponds to one-thousandth, the contact pressure of the micrometer on the sample being checked automatically by means of the microscope *A*. This process affords the advantage of eliminating any outside influence.

The supports *S* are adjustable in a vertical and horizontal direction, and allow the gage to be fixed in position and centered on the machine.

The external scale *D* allows the length of the gage in whole millimeters to be rapidly determined, the fraction of a millimeter being ascertained as explained above.

In the case of a machine intended for the measuring of a maximum length of one meter, the rule only comprises 50 centimeters. In the case of four-meter machines, the rule is one meter in length. As long as the left-hand half of the machine is used, the micrometer *M* is employed, while for measurements on the other half of the machine, the right-hand micrometer *M'* is resorted to.

The rule is formed of a scale traced on the polished surface of a nickel-steel alloy, which possesses the same coefficient of expansion as the ordinary steel mostly used in the manufacture of gages, while affording the advantage of being unoxidizable. As the tracings of the scale are only one to two thousandths of a millimeter in width, even the slightest oxidization would, in fact, cause them to disappear.

The measuring machine can be fitted with some additional devices, such, for example, as a centering support for measuring the diameter of cylinders, and a tilting support for the rapid and repeated comparison of two gages of approximately equal length.

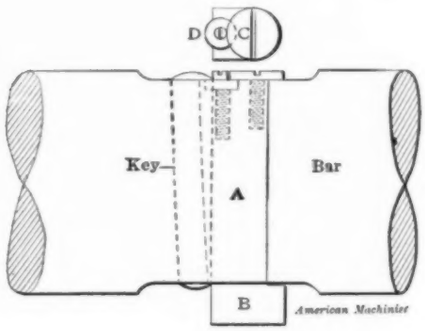
The main advantage of the machine consists of the fact that the divided rule is situated in the axis of the contact points *P* between which the sample is placed, so that the accuracy of measurements is impaired in no way by any deformation of the bed.

An Adjustable Cutter

BY WALTER G. DAMM

The line cut shows a single end adjustable cutter used in boring cylinders of gasolene engines in the turret lathe.

The tool was designed by R. Miller, foreman toolmaker of the Domestic Engine and Pump Company, Shippensburg, Penn.



AN ADJUSTABLE CUTTER

It is very simple in construction, as shown in the sketch. *A* is the cutter proper; *B*, the cutting end; *C*, the larger of the screws, is the adjusting screw, while the screw *D* is used as a locknut. The head of *D* jams up against *C* and locks it. On account of the screw *D* projecting out beyond the cutter the key was hollowed out to clear it.

The original plans of the Panama Canal called for the removal of 103,795,000 cubic yards of material; and a few weeks ago the total excavation done to date under American occupancy had reached that amount. The 71,000,000 cubic yards remaining to be excavated represent the additional work necessitated by enlargement of the canal.

Cutting Elliptical Holes in Plates

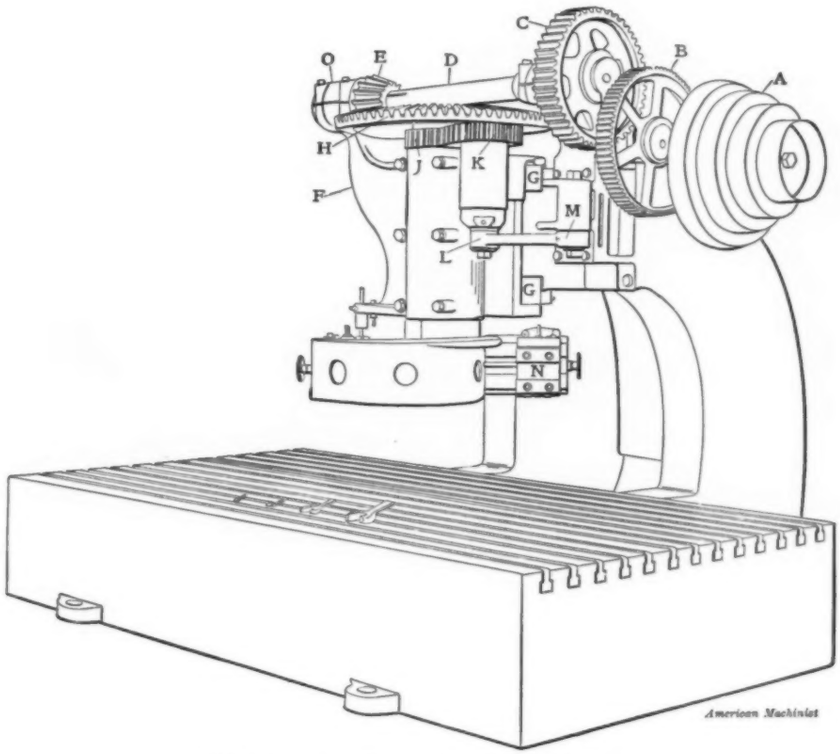
Editorial Correspondence

The way in which a gear and crank combination moves the tool head to cut elliptical holes in boiler plates or face elliptical flanges

In the accompanying line cut there is illustrated a machine made by the Bement-Miles Company, of Philadelphia, in which there is incorporated an unusual system of gearing. The object of the machine is to cut a manhole of elliptical shape in boiler plate and also to face off the elliptical flanges for the man-hole cover.

Referring to the cut, power is applied to the machine on the cone pulley *A*, and through the gearing *B* and *C*, to the shaft *D*. On the shaft *D* there turns and slides the bevel pinion *E*, this being driven by a feather, the keyway for which is shown in *D*, just to the right of *E*.

F is a casting containing the bearings for an upright shaft extending from the bevel gear *H;* also the upper left-hand portion of *F* forms an outboard bearing



MACHINE FOR BORING ELLIPTICAL HOLES

O, for the shaft *D*. A sleeve on the pinion *E* extends through the bearing *O*, ending in a collar on the far side.

Spur gear *J* is mounted upon the same vertical shaft with *H*, and turns with it. Meshing with *J* is the spur gear *K*, this also being mounted upon a vertical shaft in a bearing which is part of the casting *F*. On the bottom end of the vertical shaft carrying *K* is a crank, at *L*. Swinging on a crank pin at *L* is the connecting rod reaching from *L* over to the pin *M*. The pin at *M* is held rigidly by the main housing of the machine and does not move.

Tool holder *N*, on the end of the arm, rotates with the vertical shaft which carries the bevel gear *H* and it will not be difficult to see that as *H* is made to rotate, also turning the spur gear *K*, and the crank at *L*, the link attached to *M* and to *L* will cause the casting *F* to be drawn back and forth, from right to left, along the face of the main housing of the machine. Suitable ways, or guides are provided at *G*.

As the casting *F* slides back and forth, parallel to the axis of *D* carrying the bevel gear *H*, the bevel pinion *E* is also forced to travel along with *F*, maintaining the same relative position with *H* and continuing to mesh with it. As the tool on *N* rotates upon the shaft carrying *H* and this shaft is caused to slide back and forth across the machine, it will easily be understood that the tool in *N* will cut an oval or elliptical track in the work fastened to the bed of the machine.

The tool holder *N*, when simply cutting through the plate, does not travel along its horizontal arm, but if it is desired to face the manhole flange, the star wheel just to the right is made to traverse the tool head *N*, in or out along the arm that carries it. In this case, the tool on *N* not only makes an elliptical track, but will also act as a facing tool. Another star wheel placed just above *N*, although not shown in the line cut, can be made to give a vertical feed to the tool. The opposite arm of the casting carrying *N* may carry another tool but this, of course, is used only when cutting round holes.

For altering the size, or relative dimensions of manhole, the crank pin at *L* is adjustable to vary the stroke of *F*. The radial position of *N* adjusts for the shorter diameter of the ellipse.

A Scheme Worth Imitating

BY J. F. HOBART

The use of second-hand machines is well exemplified negatively by a large concern in northern Indiana. While the scheme described below was applied particularly to typewriting machines by the concern in question, it also applies equally well to a large number of machines, both general and special.

The manufacturing concern referred to, found that they very materially reduced their bills for typewriting machines by replacing their machines with new ones every two years! It looks extravagant, at first sight, to junk a dozen typewriters only two years old, but the concern figures it thus: After about two years, bills for repairs begin to come in.

But when a machine is only two years old, we can "trade it back" in exchange for a brand new machine at a considerable less amount of money to boot than the bills for repairs and the loss of time, would amount to in another two years. Therefore it is found profitable to replace the machines about every two years as stated.

There is another side of this matter which has not been set forth very prominently, and which applies with even greater force to some machine tools than it does to typewriters—it is this: By replacing a machine the moment the first repair bill appears, or as soon as the makers have brought out an improvement, they not only obtain the best and cheapest output that can be secured, but by selling the obsolete tools, they hamper the competitor who may chance to purchase their discarded machinery—handicap him by making him use machinery which has been thrown out as less efficient. Pretty good logic, this—handicapping your competitor while improving your own output!

Milling an Accurate Machine Slide

By A. J. Baker *

The tumbler slide of the Cincinnati high power miller is accurately milled to bring the flat and dovetailed bearing surfaces in correct relation to each other and the right distance from the shaft centers.

Details of the fixtures, cutters and gages employed, and record of speeds and feeds used.

Although commercial milling is to some extent of that class which calls for no particular relation between the milled surface and a previously machined surface, there are many cases where the milling is one of the later operations, and where the limits of accuracy are very close. The example illustrated herewith combines both of these features.

The piece in question is the tumbler slide used in the drive boxes of Cincinnati high-power milling machines. A feature of its construction is the dovetailed slide which moves on a gib fastened to the inside of the drive box. There is no adjustment between this gib and the slide, with the result that both pieces must be machined with sufficient accuracy, so that a few strokes of the scraper on the angular faces will produce a working fit.

The Requirements to be Met

It is furthermore necessary that the dovetailed slide shall be in proper relation to the two spiral gears carried in the frame of the slide, which are used to rotate the tumbler. It will, therefore, be seen that the following requirements have to be complied with:

1. Plane surfaces for the flat and beveled faces.
2. An accurate dimension from sharp corner to sharp corner of the inner angles.
3. An accurate dimension from the flat face to the center of the main shaft.
4. An accurate dimension from the sharp corner of the bevel to the center of the main shaft.
5. The flat face to be square with the small shaft.
6. The center of the small shaft to coincide with that of the beveled faces.

Referring to the illustrations, Fig. 3 shows the tumbler slide. It will be noted that the casting, which is of steel, is of a very irregular shape. The bearing parts are denoted by the letter *A* and *B* shows a bracket which is bolted to this slide and forms the second half of the tumbler bearing. The main and smaller shaft holes are marked respectively *C* and *D*.

First Operation Milling Fixture

The first operation on this piece is that of rough milling the flat and angular faces. Figs. 1 and 2 show the fixture mounted on a No. 4 Cincinnati high-power miller and the details of the fixture. The cutters employed are a 7½-inch standard-face mill screwed direct to the spindle nose, a 2-inch spiral-end mill with taper shank, and a 45-degree taper-shank angular mill. The first cutter remains permanently on the spindle nose while the job is in progress, the second and third cutters being changed to first rough out most of the stock, and secondly rough out the bevel.

The fixture consists of a body with three fixed supporting points *E*. Immediately over these are three clamps, the end of which carry hardened-steel points. The work is held against an end stop by the set screw shown at the right-hand side of the fixture, and is backed up by two fixed points *G*, and three adjustable screws *H*. These three screws, having been set up, may be locked by thumb screws. At the end of the fixture is a steel setting piece.

Cutters, Feeds and Speeds

The work being chucked, the operator sets the face mill to within 1/32 inch of

*In charge jig- and tool-designing department, Cincinnati Milling Machine Company.

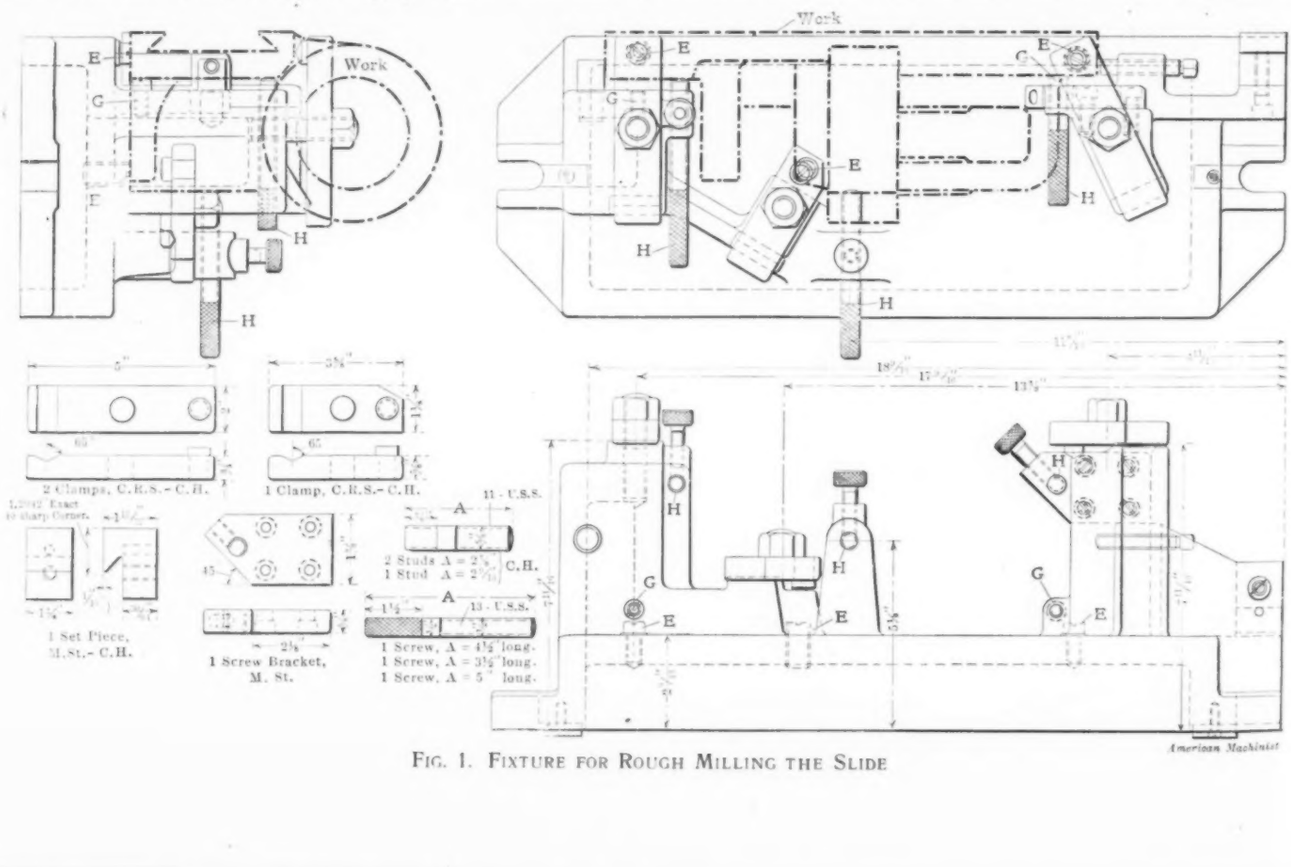


Fig. 1. Fixture for Rough Milling the Slide

the setting piece, and starts the feed over the flat face. At the end of the cut the table reverses and the cutter takes out the spring in the work. The end mill is then inserted in the spindle and the dovetail piece is roughed out to the proper depth plus the 1/32 allowed on the face milling, at the same time finishing in four cuts (two upper and two lower) the narrow flat edge which removes the sharp corner. The end mill is then removed and the angular mill substituted. With this the beveled faces are rough and finish milled to 1/32 smaller than the drawing size. For this purpose the gage shown in the table in Fig. 2 is used.

The feeds and speeds used are as follows: For the first cut and for the return the speed is 26 revolutions per minute, the feed for the first cut being 0.088 inch and for the return 0.239 inch. The speed for roughing out and finishing the slot and for roughing and finishing the bevel faces is 76 revolutions per minute; the roughing of the slot is done with a 0.053-inch feed; the finishing of the slot with 0.143-inch feed, the bevel surfaces are roughed at 0.026 and finished with 0.068-inch feed.

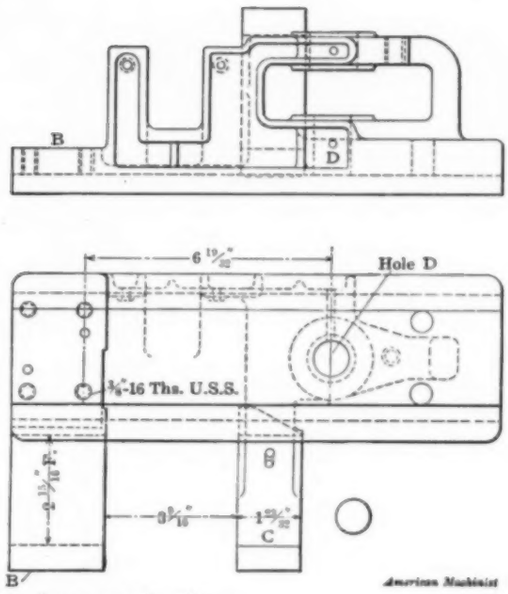


FIG. 3. THE SLIDE TO BE MILLED

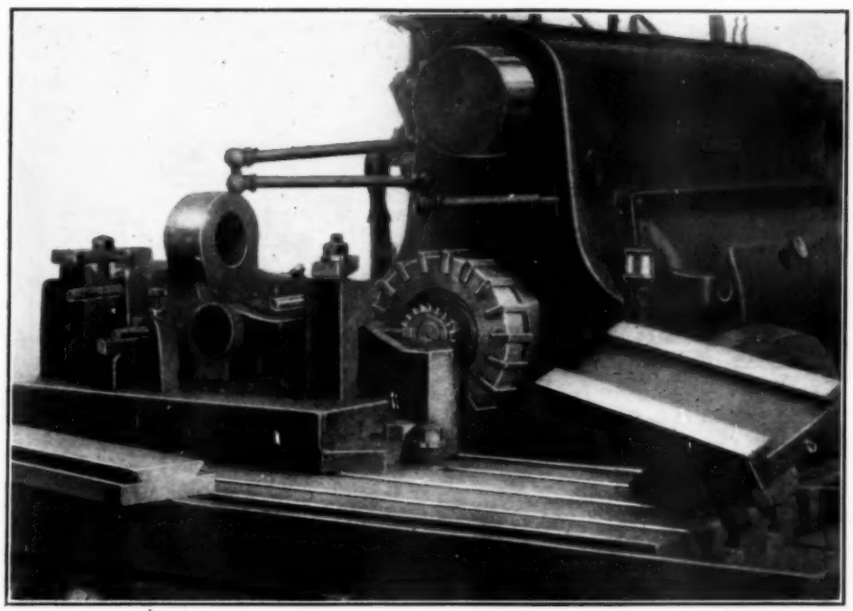


FIG. 2. ROUGH MILLING BEARING SURFACE IN A SLIDE

The amount of stock removed is considerable, reaching on the face as high as ⅜ inch, and in the slot to ½ inch, which holding it constitutes a tolerably heavy milling job.

THE FINISHING FIXTURE

The next operation is that of milling the surface to which bracket *B* is attached. The holes are then drilled and the bracket is fastened to the tumbler, and from that time is treated as one with it.

This is followed by the boring of the remaining holes in the bracket and slide, which then returns to the milling machine for the final operation. This operation consists of finish milling the flat and beveled surfaces. The fixture is shown in detail in Fig. 4, and mounted ready for work on a No. 4 Cincinnati vertical miller in Fig. 5. Figs. 6, 7 and 8 are details of the gages and special cutters, and Fig. 9 shows, perhaps more clearly than the drawings, both the work and the complete tool equipment. Referring to the fixture, this will be seen to consist of a bracket, bored to receive two plugs, which correspond in dimensions and location with the main bored holes in the work. The plug, which fits in the smaller hole, is permanently in the fixture. The hollow plug fitting in the larger hole can be removed for the insertion of the work. The piece is inserted in the fixture in the following manner. The adjusting support screws *J* and the side support screws *K* are first withdrawn. The slide is then slipped over the fixed plug and adjusted vertically until the

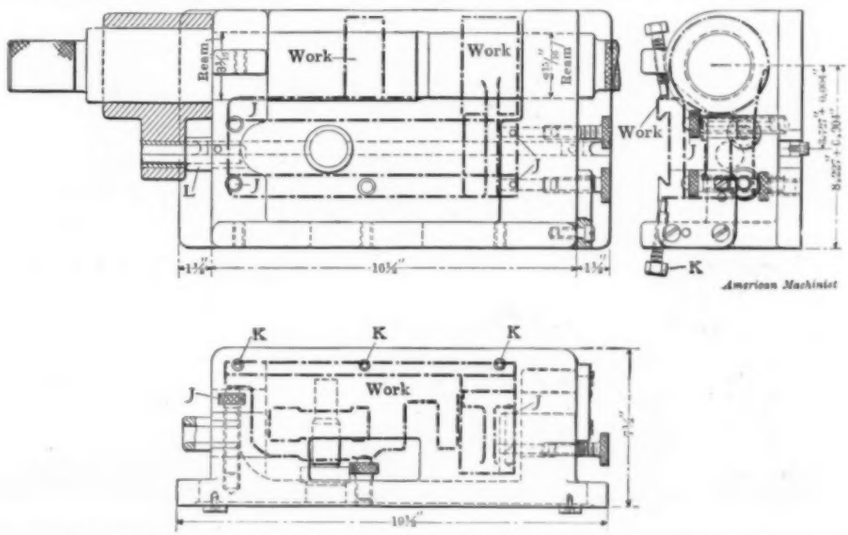


FIG. 4. MILLING FIXTURE FOR FINISHING THE SLIDE BEARING SURFACE

large plug can be inserted, both in the fixture and work. Should there be any error in the boring of these holes, the plug would not enter, and the mistake would be discovered. With the plug in place, however, the support screws are adjusted to do what their name implies, which is to support and not spring the work.

Setting Cutters and Gaging the Work

With the combination mill shown in Fig. 8, the finishing cut on the flat face is started, the beveled cutter also working on that bevel face of the work remote from the operator. The diameter of the large mill is sufficient to permit of its reaching over both sides of the flat face. The setting for this cutter is obtained from the hardened plate at the end of the fixture. When the cut has passed completely over this surface, the trygage shown at the right of the photograph, Fig. 5, is used. This gage, which is incorporated in the fixture, is composed of a bracket carrying a hardened-steel gaging surface, which is caused to assume the correct position by the gage sliding on the locating plug and being guided by the plug, which fits in bushing *L*, Fig. 4, in the end of the fixture. Now, as the cutter is prevented from taking out too much by means of the fixed setting piece of the fixture, it is also forced to take out enough by the trygage, which would otherwise not enter the work.

A Micrometer Gage

Having completed the one side, the saddle is moved over, and a rough finish cut taken over the second bevel face. When this cut has been completed, the micrometer gage, Fig. 6, is used to determine the amount to be removed by the final finishing cut, thereby eliminating the cut and try process, which in a job of the accuracy here required, is slow and tedious. The gage has two main parts, a body having two flat surfaces and one beveled surface, and a sliding block having the remaining beveled surface. These two parts are adjusted outwardly by the nurled thumb screw, and when so adjusted are followed up by the micrometer head, which, striking a hardened plug in a sliding block, gives an exact reading in thousandths, of the

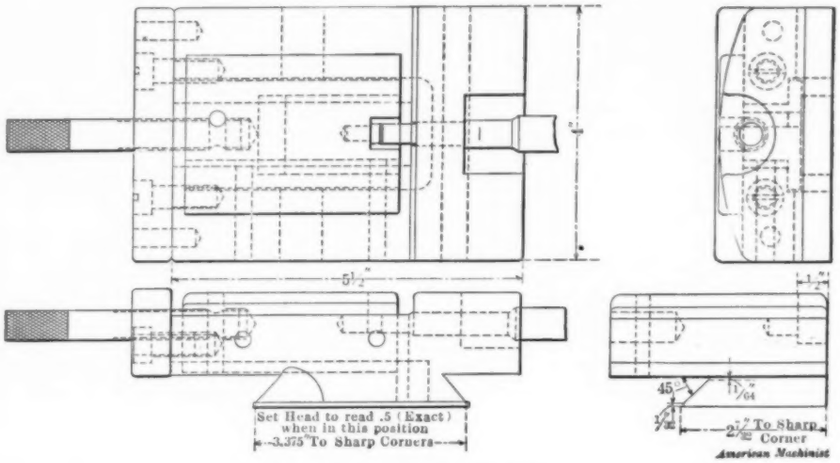


Fig. 6. A Micrometer Gage

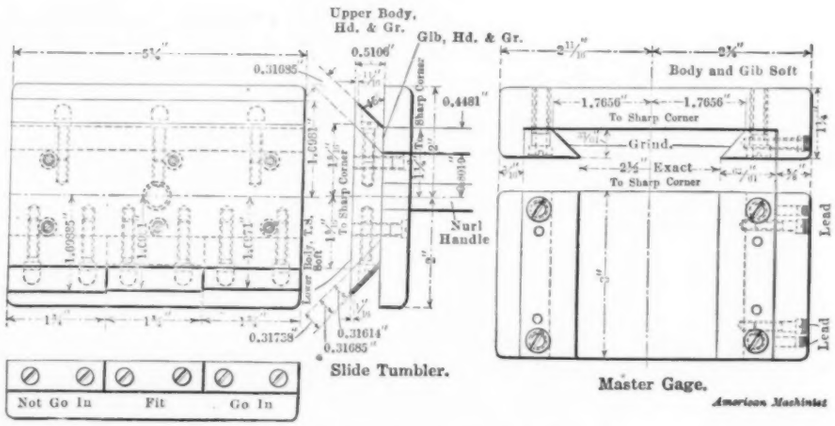


Fig. 7. Working and Master Gages

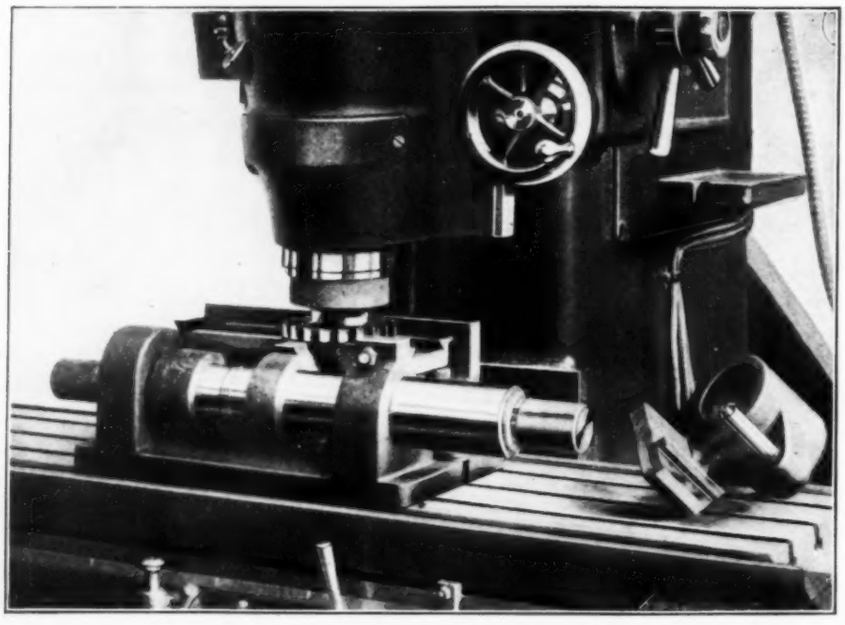


Fig. 5. Finish Milling Operation

amount of metal to be removed. This same reading can be transferred directly to the cross-screw dial and the work accurately finished. The micrometer is so set that the proper dimension gives a half-inch reading on the barrel. The micrometer itself is not subjected to any strain, such as may be imparted to an ordinary micrometer, as the whole of the adjusting to the work is performed by the thumb screw.

The Finishing Gang and Gages

The finishing gang, Fig. 8, is made up of a carbon-steel form relieved taper-shank angular mill. On this is keyed a side and a face cutter also of carbon steel, which is held against the shoulder of the angular mill by the locknut behind it. The carbon steel is, of course, used on account of the finer finish which it will give, such finish greatly reducing the amount of time that would otherwise have to be spent by the scraper. As a final test of accuracy, the master and working gages shown at Fig. 7

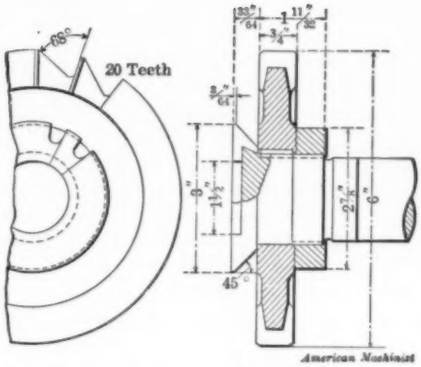


FIG. 8. THE FINISHING GANG OF CUTTERS

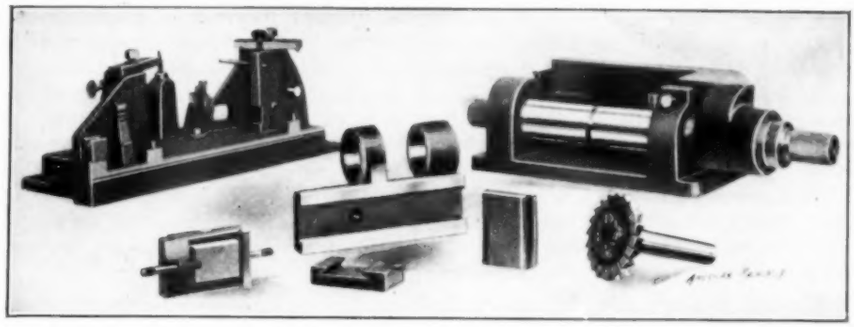


FIG. 9. THE WORK AND COMPLETE TOOL EQUIPMENT

are applied. The working gage has its beveled faces made up of flat, hardened strips, on the one side of an even thickness and on the other of varying thicknesses, set to give the limits within which the job must be milled. The master gage has one fixed side gib and one movable side gib, which having been once adjusted, is closed against readjustment by having the screw holes filled with lead.

This feature is clearly represented at the right-hand side of the two views of the master gage in Fig. 7.

SOME ADVANTAGES OF THE METHOD DESCRIBED

It may be thought that the cost of such an equipment is prohibitive, but it must be considered that the costly parts, such as gages, cutters, etc., are applicable to all sizes of high-power millers and that two sets of fixtures only are needed for the complete line. It may also be asked why the milling was not completed at the first operation. This was at first tried, but the clamping of a separate bracket to the tumbler slide, the boring and facing of the large holes, the drilling out of the solid steel of the small holes, entirely spoiled whatever accurate work was put on the first operation. As before stated, the amount of metal removed in proportion to the weight of the casting is very great, and releasing strains set up in the casting will distort it as much as 1/32 inch.

As a result of the methods employed in connection with this work, it is possible for any slide and any gib to be fitted together, bringing the gears in exact relation.

Friction Drum Assembling Fixture

By S. O. Brown

It was necessary recently to assemble several hundred friction drums comprising a bronze V-pulley revolving on a central driving member and operated by the friction due to the pressure of two hardened-steel shoes, pressed outwardly against the inner circumference of the pulley by means of two stiff helical springs. Each of the springs when compressed, exerted a thrust of 100 pounds and difficulty was experienced in the assembling operation. The problem of compressing these springs, so as to get the shoes slipped into place was solved by the construction of the assembling fixture shown herewith.

In Fig. 1, *A* is a base plate of cast iron, on which are mounted two guide strips *B* made of machine steel, carbonized and hardened, and the fixed jaw block *C*, also of machine steel, case-hardened. These pieces are secured to the base by means of large dowel pins and heavy fillister-head screws.

Between the guide strips slides a case-hardened machine steel jaw *D*, motion to which is imparted by means of a cam-ended lever *E*, rocking about the shouldered screw *F*. A tension spring *G* attached to the lower surface of the sliding jaw by a small spring stud and similarly attached to the base, serves to open the jaws of the fixture when the lever is released. A case-hardened steel stud *H* between the two jaws, is threaded at its upper portion to receive a nurled nut *J*, which bears upon the retaining block *K*, and thus prevents the friction shoes from tilting and snapping out of the fixture jaws while the springs are being compressed.

In operating the fixture the nut and block are removed from the stud *H*, the friction shoes are then placed in position against the circular jaw flanges, with the retaining block screwed down above them by means of the nurled nut and the springs are then placed in position between the friction shoes, after which the cam lever is operated, compressing

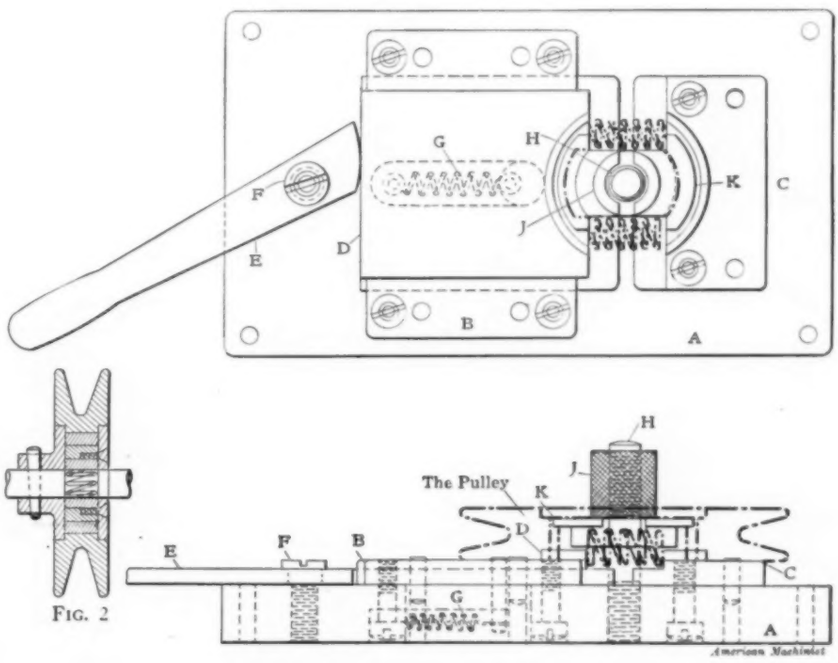


FIG. 2

FIG. 1. AN ASSEMBLING FIXTURE

the springs sufficiently to allow the V-pulley to slip over the outside of the shoes. The cam handle is then released and the nurled nut and retaining block removed, so that the pulley with the shoes and springs in it can be removed from the fixture.

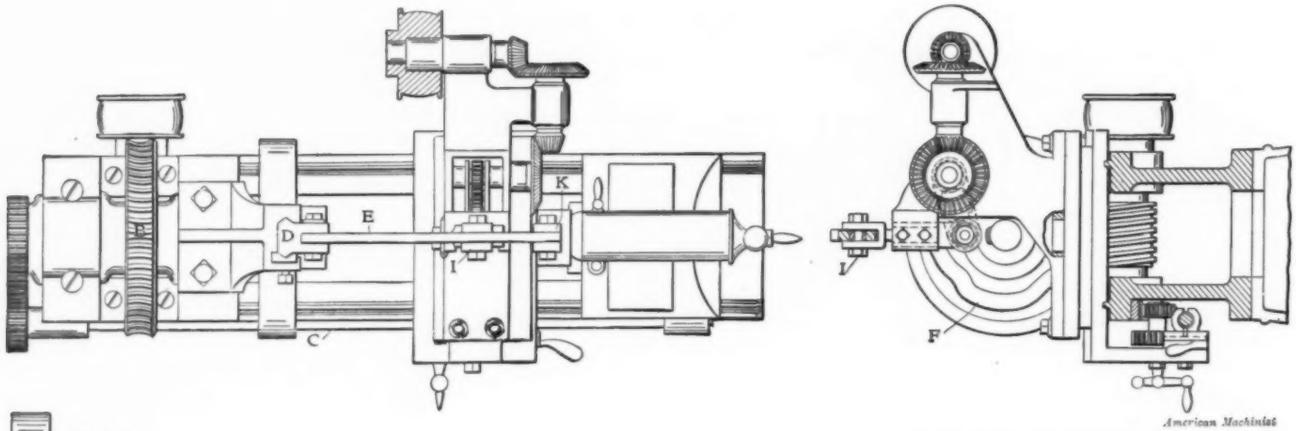
The upper end of the stud *H*, after being threaded, has the threads cut away on opposite sides for about 90 degrees of its circumference, and the nut *J* has its threads removed in a similar manner, so that a quarter of a turn of the nut will bring the threads on the stud opposite the slots in the nut, permitting it to be drawn straight out, without the necessity of screwing it down the entire length of the threaded portion of the stud. This breech-lock construction may be often used advantageously on jigs and fixtures, where a quick-acting release is desired.

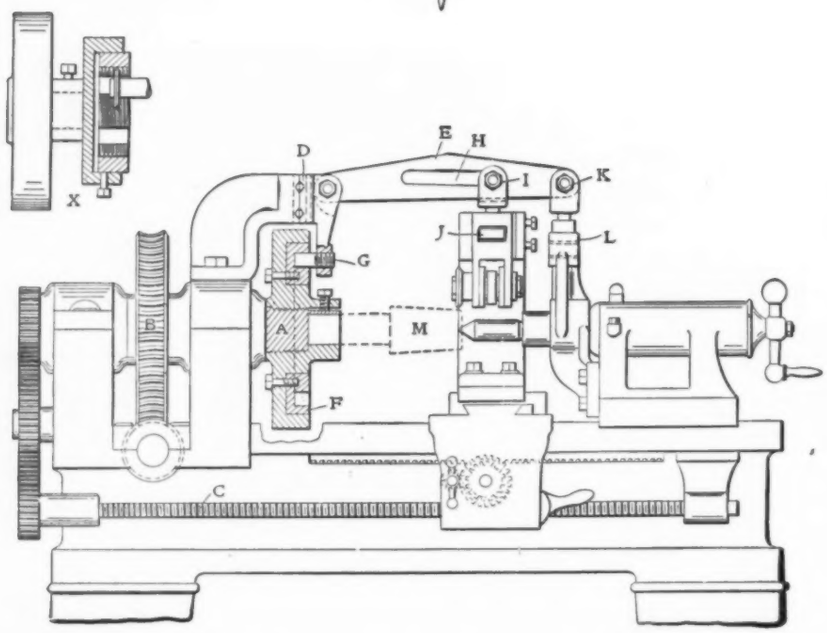
A section through the friction drum is shown in Fig. 2, and it will be noticed that on account of the annular recess on each side of the pulley which forms its bearing, the friction shoes must be entered into the pulley more than one-half of their thickness beyond the edge of this recess. Otherwise, as soon as the nut and block are removed from the fixture, the shoes and springs will not be prevented from flying out.

Thread Milling, Relieving Machine

A machine built along the lines of a lathe designed for simultaneously milling and relieving the threads on taps and dies

The line cuts show a machine invented by Christopher Berry, 708 Tully street., Syracuse, New York. One of the machines has been built and has proved very satisfactory. In form the machine is similar to a lathe. The main spindle *A* is driven by the worm gear *B*, motion being transmitted to the lead screw *C* in the usual way through change gears. Mounted on the front housing of the headstock is a bracket having a slide *D*. Working in this slide *D* and pivoted at its other end to a bracket fastened to the tailstock is a guide lever *E*. Mounted on the nose of the spindle is a face cam *F* which is shaped so as to give the desired relief to the tap. Working in the cam groove is a pin which is attached to the lever *E*. As the cam *F* turns the lever *E* is actuated up and down in the slide *D*. The lever *E* is provided with a slot *H* in which the piece *I* slides. The piece *I* is secured to the bracket which carries the thread-milling mechanism and is provided with vertical adjustment by means of the nut *J*.





A Machine for Simultaneously Milling and Relieving the Threads on Taps and Dies

The pivot *K* on the end of the lever *E* is also provided with means of adjustment at *L* so that taps of various degrees of taper can be milled. In operation the tap *M* is placed in the machine as shown and the machine is started up. As the carriage carrying the milling mechanism advances the guide piece *I* travels in the guide slot *H* and a tap is milled the same taper at which the guide slot *H* is set. The cam *F* reciprocating the lever *E* up and down, raises and lowers the milling mechanism and relieves the tap. For milling relieved dies the fixture *X* is secured to the front of the cam plate *F*, and with a suitable cam for die-relieving in place in the machine the die is simultaneously threaded and relieved in the same manner as the tap is relieved. Means are, of course, provided for swiveling the milling head to the angle of the pitch of the thread.

Good Results From Premium Plan

By William Lodge *

Advantages obtained by starting the premium plan from reliable records and by setting and maintaining rates which allow men to earn good premiums.

Getting maximum results by including the foremen and superintendents in the premium arrangement.

Extending it to the accumulation of a pension fund for those who grow old in the service.

Let me begin by saying that the object in adopting this plan was to increase the production of the shop. It is not intended to be philanthropic in any way, but is a plain business proposition to encourage men to increase their output by giving them a fair share of the increase so obtained, as has been shown by Fred A. Halsey, who originated the plan.

Years ago, when I was working as a journeyman, I learned that almost every man can increase his output materially if he has a sufficient inducement to do so. And the most effective inducement is to be given a chance to earn a larger amount in the pay envelop. It was in the panic of 1873 when I was making lead screws for a lathe maker of those days that this lesson first came home to me in a concrete form. We had been getting $9 each for the lead screws and were doing a fair day's work to make one in three days. Out of perhaps 60 men, only three remained, and I was one of the three.

The boss called us into the office and said that if he could build a few lathes at a low price, he would make a few for stock and wanted our best figures as to what we could do. I bid $5 each for the lead screws and started in on the job.

Being used to the work, I began thinking out little helpful kinks that enabled me to make a lead screw in a little over a day each, and was glad to earn more than before, even at a lower rate per piece. And the boss was equally glad to get the lead screws for a little over half the former cost.

Starting a Premium Plan

One difficulty in starting any kind of a premium or bonus system, is to get the rates fixed right at the start. Unless you have actually been making the piece for some time and know it thoroughly, it is not easy to get a time that will be fair to both sides. The experience of the foreman and the time or cost guesser is very apt to go astray and the rate to be either too high or too low. And any considerable changing of rates has a bad effect on the men, as it shakes their confidence both as to judgment and to square dealing.

We were exceptionally fortunate in that respect as we had a pretty accurate record of the cost of lathes of various sizes and in different sized lots, extending over a period of 12 years. This gave us a good basis to work from and with few exceptions, we took an average of the last three years of the record as a standard for time to be allowed. We knew that these times would be bettered in nearly every instance, but we were willing, yes, wanted the men to earn more to make it an object to strive for an increased output.

It is sometimes questioned, and perhaps not without reason, why straight piece work is not better and fairer, as it gives a man the same price for the last piece as for the first. But the increased output either with piece work or premium plan, is not all clear gain to the manufacturer, as can readily be shown.

In our own case, and it is probably true in most others, the increased output increases such overhead charges as power, belts, lubricants, etc., as well as laborers to assist in handling the work in and out of the machine or from department to department. We do not want a skilled mechanic to waste his time and energy doing heavy lifting, as he can produce more at his own work. So we gladly supply increased help, but the cost of this and the time-keeping and clerical work must be met in some way.

This is why we consider it perfectly fair to divide the time saved evenly with the men, although some only allow them one-third instead.

Maintaining the Rates

Having set our time limits as the result of our 12 years' experience, we have stuck by them in almost every case, even when the men doubled and trebled their output. Some of my fellow manufacturers who have never been through the mill themselves, insist that the men must have been purposely loafing or wasting time before in order to make such gains under the present plan. Personally, I do not agree with them, as good men do not intentionally waste time under any plan. But there is nothing like a tickling of the pocket-book nerve to make any of us sit up and take notice. Then we begin to look around for ways and means to do the work quicker.

The beauty of the premium plan is that it allows the men to earn much better wages and at the same time you can see the direct gain in the lessened cost per piece, in the shorter time an expensive machine is tied up on one job, and in the increased output of the shop. But to secure the best results the rates must be maintained until some radical change in method is introduced, or the output will not increase beyond the point the man considers safe. Nor can a man be blamed for not doing his utmost when he is sure that his rate will be cut if he passes the "dead line" of wages for that particular shop.

When it becomes necessary to change a rate, and it will in all shops at some time or other, be perfectly frank about it. Call in the man or men, or better yet, go to them and tell them just why the change is made. This leaves the atmosphere much clearer than to post a cold-blooded notice that "on and after such a day ——" etc., etc.

Passing the Premiums Down the Line

The premium plan that only affects the workmen is not getting the best results possible. No foreman is made happier by the fact that one or more of his men are drawing as much or more money than he is, in spite of his responsibility and superior knowledge. And his only incentive to push the work of his department along, is the natural pride of doing his work well for its own sake. While in theory this should be enough perhaps, a few dollars in the pay envelop helps pay the butcher and grocer and incites a keener interest in any man.

So we make an allowance to the foreman from our half of the time saved, of 2 cents an hour, for every hour saved in his department. This gives him a direct interest in keeping every man up to the mark and of helping him in every way possible.

How It Works

Instead of waiting for the apprentice or for anyone else to ask his advice on handling any job, he is constantly on the alert to see how the work can be done to the best advantage. He shows the boy how to grind the tools to cut a little better, how he can save time by using a faster or slower speed on that particular job, what feed will do the work the quickest and other equally valuable points.

This gives the boy valuable knowledge by actual, practical examples and shows

*President, Lodge & Shipley Machine Tool Company.

him the results obtained. The boy is pleased to be able to increase his earnings and the foreman has added a few pennies to his own account for the week.

Unlike the old idea that one man must lose what another man gains, this helps everybody along the line and all are happy.

To make this still more of an incentive, the foreman is charged with 5 cents an hour for any hours lost from the time limit during the week. This does not come out of his regular salary in any case, but is charged only against his premium earnings. Needless to say there are very few cases where such charges are made. Instead the premium earnings run up as high as $15 a week extra in some cases, although the average is probably nearer $14.

Where the Superintendent Comes In

The superintendent and his assistant are not forgotten, and another half a cent from our half of the saving, is credited to them for every hour saved in the whole shop. This naturally brings them very closely in touch with all the foremen and new ways and means are constantly being found to handle the work so as to increase the earnings all along the line.

The beauty of the whole system is that when an hour is saved, everybody wins. Every hour saved means increased earnings to the workman, the foreman, the superintendent and his assistant, and to us. Nobody draws a blank.

The Pattern Shop

How to get the pattern shop in on the plan was a problem, yet I did not want to leave them out. So we took what seemed to be an average year and used that as a basis.

Then we divided the saving in that department with the men, estimating the output as best we could, and had the pleasure of handing over several hundred dollars at the end of the year, to be divided among the pattern-making force. Needless to say this was very satisfactory to the men as well as to us.

The Pension Fund

And we are going a step farther than this. In addition to the 2½ cents for every hour saved which comes out of our half of the total savings, we are setting aside another 2½ cents per hour in a fund to be used for paying a pension to men who have served us long and well.

This plan was very carefully worked out for us by the head of an institution which pays out millions in this manner. The plan promises to be very successful in every way. It provides for every employee when he reaches the age of 65 years and who has been in our employ 25 years or more. This does not shut out the man who is over 30 years of age when he comes to us as is done in some cases and the pension will be a larger percentage of his earnings than is included in most of the pension plans I know of.

How the Records are Kept

Four shop timekeepers are employed, each having a definite portion of the shop to look after and keeping track of the work of every man in his department. These may visit each man as often as ten or more times a day, thus keeping accurate tabs on the work. These timekeepers record the commencement and ending of every job, both to keep track of the work and to know what its labor cost has been. No shop time is allowed for the cleaning up of a machine, this going in with the job time. The time for setting up a machine is charged to the job that is to be done.

This information goes at once to the cost department where it is tabulated with the Hollerith machines, which have been described in your columns, and which are similar to the machines used in counting the census.

The cost department also has all details as to weight, parts on hand in a finished or unfinished condition, and knows the exact condition of every order going through the shop.

The net results of the time taken are tabulated on the form shown in Fig. 1. The work of the men under each foreman is recorded on one of these forms, and as can be seen, it shows the main details of the work each week. The hours lost or gained are shown at a glance and it is an easy matter to look for and find why the time has fallen behind in any particular case.

A condensed summary of this is recorded on special forms for any particular size of lathe. These forms show at a glance the variations in both hours and dollars, in the cost of any operation on the size of lathe under consideration. These costs vary with the number of lathes in the lot, the larger the lot, the lower the cost per piece, as would be expected.

A striking example of this came to notice where a lot had to be broken up in order to get part of them through for a special order, during the dull times of two years ago. These lathes cost nearly twice as much as though they could have gone through in the regular way. This was partly due to the fact that we were keeping our organization together during a slack period.

Some of the Results Obtained

We extend the premium plan from the cleaning of castings to the scraping in of the beds, and from one to the other, including all between, we have been more than pleased with the results. This in-

STATEMENT OF PREMIUM.

Ck. No., 278. Name, Joe Jacobs.

Dept..... Week Ended, February 10, 1910.

Ck. No.	Workman's Name	Operation	Amt. Pcs.	Sym.	Name Piece	Shop No.	Pc. No.	Limit	Cons.	Hrs. Lost.	Hrs. Gain.
275	E. Hopewell	Drill	36	H	C/S gear, No. 1, 2, 3	3256	308-9-10	1³	1⁹		0¹
275	E. Hopewell	Drill	100	D E	Eye bolt	3200	347	3¹	1³		1⁹
275	E. Hopewell	Drill	96	F G H	C/S frict. disc bush	3256	316	9²	2²		7
275	E. Hopewell	Drill	400	D E	C/S shift. collar	3200	331	20	8		12
279	W. Grote	Assemble	18	F	Hangers, C/S	3254	E	5²	3²		2
279	W. Grote	Assemble	32	F	Pat. hd., C/S	3256	G	8	1¹		6³
280	B. Poppe	Assemble	54	F	Pat. hd., C/S	3254	F	5³	1		4²
280	B. Poppe	Assemble	60	D E	H/S countershaft	3198	A	330	148³		181¹
284	P. Koppe	Assemble	50	C	Folled rest	1909	791	37²	28³		9
284	P. Koppe	Assemble	100	D E	Folled rest	2010	791	133¹	51¹		82
285	G. Blackburn	Drill (5) holes	12	D E	C/S, frame	4696	301	5³	2		3²
285	G. Blackburn	Drill complete	60	H	C/S, fr. sleeve band	3256	342	14	7³		6¹
285	G. Blackburn	Drill complete	60	D E	C/S, frame	3198		55	56	1	
								Totals....	10711	5083	1	563³

Gained 563½ hrs. @ 0.02c. per hr. = $11.25.

Lost 1 hrs. @ 0.05c. per hr. = 0.05.

Amt. Credited, $11.20.

Amt. Charged, ...

THE FORM USED TO SUM UP THE TIME GAINED OR LOST

cludes both the lowering of the cost per piece and the increased output of the plant.

This means that we are getting more and better work per dollar of capital invested in equipment of all kinds, which is the most desirable way to increase the output of a shop.

The premiums last year, which was not a normal year in any respect, amounted to over $20,000. This represents increased earnings of the men, giving them a greater purchasing power, and in that way must have helped business in general in Cincinnati besides having many other good effects.

In closing, let me repeat, that this is a business proposition in every way, and does not pretend to be anything else. Nevertheless I feel sure that the good fellowship and personal feeling promoted that has resulted from a closer union of interests, has been beneficial to all concerned.

Breakage of Car Wheel Axles

Editorial Correspondence

A case where the structure and quality of the metal was blamed for breakages that were really due to improper designing

In the investigation of the causes of breakage of car-wheel axles by the L. H. Goodnow Foundry Company, of Fitchburg, Mass., on axles which were used by the local street railway company, some interesting data were obtained.

In Fig. 1 are shown four axles that developed cracks and were run for different lengths of time, and the results noted. At the broken parts these axles were three inches in diameter, and the chemical analyses of two different axles were as follows:

Carbon, 0.54 per cent.; sulphur, 0.046 per cent; phosphorus, 0.022 per cent.

Carbon, 0.53 per cent.; sulphur, 0.023 per cent.; phosphorus, 0.037 per cent.

The axle shown at *A* was only run for a short time. It developed slight checks at *E* and *F*, was taken off and broken to investigate the metal. This proved to be of a good grain, with no signs of pipes, blow holes or other imperfections. One of the chemical analyses given above was taken from this axle.

The one shown at *B* was run for a longer period of time and in this the break extended completely around the axle at a practically uniform depth. This would indicate that it was subject to alternating vibrational strains.

The axle at *C* was run for a still greater length of time, and while the crack extended around the entire circumference of the axle, it was not very uniform in depth; the depth at *G* being 11/16 of an inch, while at *H* it was but ⅛ inch.

The axle shown at *D* was not taken off from the car until it had broken, and on this the crack extended to within ⅜ of an inch of the center.

Many reasons were given for these breakages, but as there were no flaws in the metal, and it seemed to be perfectly homogeneous, with a grain of fine texture, it was difficult to locate the exact cause. The chemical analysis of the metal was also good, and this could not be given as the reason.

The dimensions of these axles are shown in Fig. 2. The upper figure shows how all of the axles were made that had broken. It will be noticed that between the 3- and 3½-inch diameters there was a ¼-inch fillet, and as all of the breaks occurred in this fillet, the company decided to try a larger one. Therefore, one year ago they adopted a fillet of 1⅝ inches radius between the 3- and 3½-inch diameters of the axle, as shown in the lower figure, and since then no breakages have occurred.

Many failures in metals that are blamed to the composition or structure of the metal, the mechanical working or the heat treating of the same, can often be overcome by slight changes in the design, as shown here.

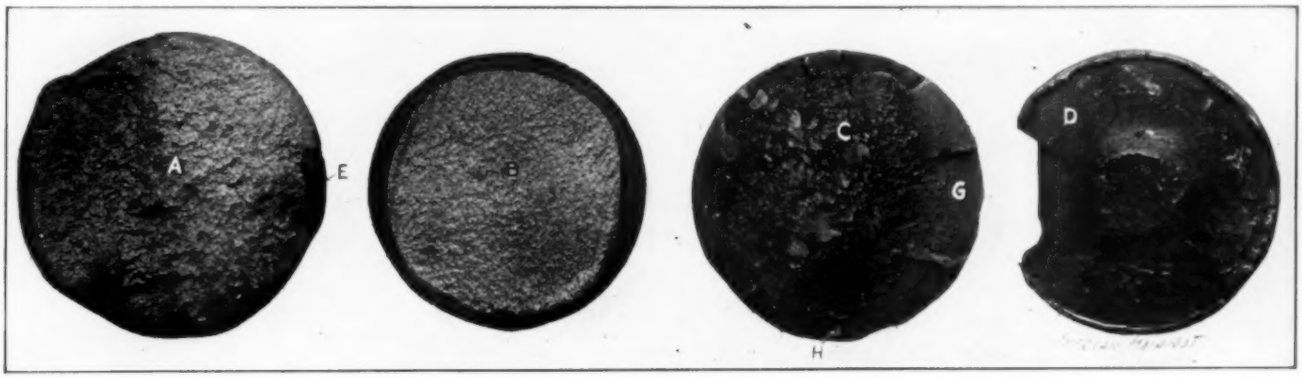


FIG. 1. CAUSE OF BREAKAGE IN CAR WHEEL AXLES

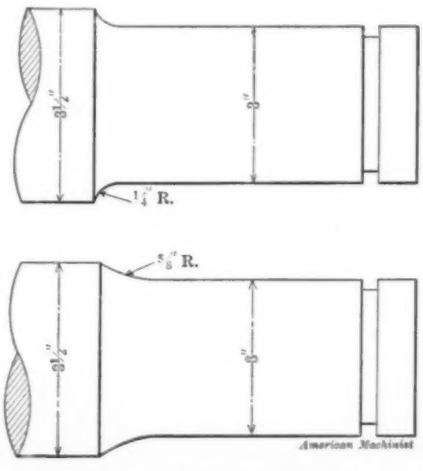


FIG. 2. SHAPE OF AXLES

An application of automatic mechanical methods on work naturally suggesting the necessity of manual labor is pointed out by a contemporary as follows:

Sharpening the bits of the three hundred rock drills used in the Calumet & Hecla mines, is done automatically, the only labor being to put them on a conveyer at the outset. They are heated, sharpened, upset, fluted, brought back to exact size and tempered by machines, passing from one to the other mechanically. The plant is driven by electricity, but the sharpening and upsetting are performed by compressed-air hammers, and the fluting is done by an eight-hundred pound steam hammer. With all drills running, about 4000 bits must be sharpened every day.

Patternmaking for Bulldozers—I

By Jabez Nall

The procedure in making patterns for Ajax high speed bulldozer. Selection of proper metal, shrinkage allowance, molding methods, patternmaker's lay-out, etc. A large casting on which representative methods, that may be generally applied, are involved

In making the patterns for any large or intricate casting there are always a number of points that must be considered and fully solved before any of the actual work on the pattern can be started.

First among these is the question of the kind of metal of which the casting is to be made. Coupled with, and contingent upon it, is the question of the amount of shrinkage. This, of course, varies in theory at least, according to the difference in the composition of the metal. For instance, the metal may be designated as cast iron and the shrinkage still vary. It may be of a very soft grade of iron the shrinkage of which is below normal; it may be of the standard grade; or it may be that a greater tensile strength is specified and therefore have added some 20 to 25 per cent. of steel clippings, steel scrap, or some such material to close the grain and thus make the shrinkage above normal.

Experience shows that the patternmaker is more apt to err by allowing too much for shrinkage than too little. The question of the straining of the mold, under pressure of the metal, when pouring and the retardation of shrinkage in a cored mold does not enter sufficiently into his calculations.

The frame under consideration in this article was made of a cast-steel mixture that, according to formula, should require the full standard allowance of 3/16 inch to the foot for shrinkage. Where the design is such that the shrinkage is unretarded, this is not too much.

Differences in Shrinkage

In a casting of somewhat similar design, that was made in a mold composed very largely of cores and hence the shrinkage retarded, I made a shrinkage allowance of ⅛ inch to the foot. These castings, while varying a little in length, were all too long and we had to depend on a generous finish allowance to take care of the length. This time, figuring on previous experience, the pattern was made with an allowance of 1/10 inch to the foot. The first casting was measured when cold and before being annealed, and in a length of 11 feet 9½ inches it was still ⅜ to ½ inch long. After annealing, it was again measured and found to have shrunk ¼ inch more, which did not give a bad result.

The distance between the center of the crank shaft and the face of the toes was 5/16 inch too much, but as there was ½ inch allowed for finish on the face of the toes, this machined up very well. These figures are given to show that the patternmaker must consider the design and distribution of the metal, as well as the make-up of the mold, before deciding the amount of shrinkage that should be allowed. The tendency of the casting to

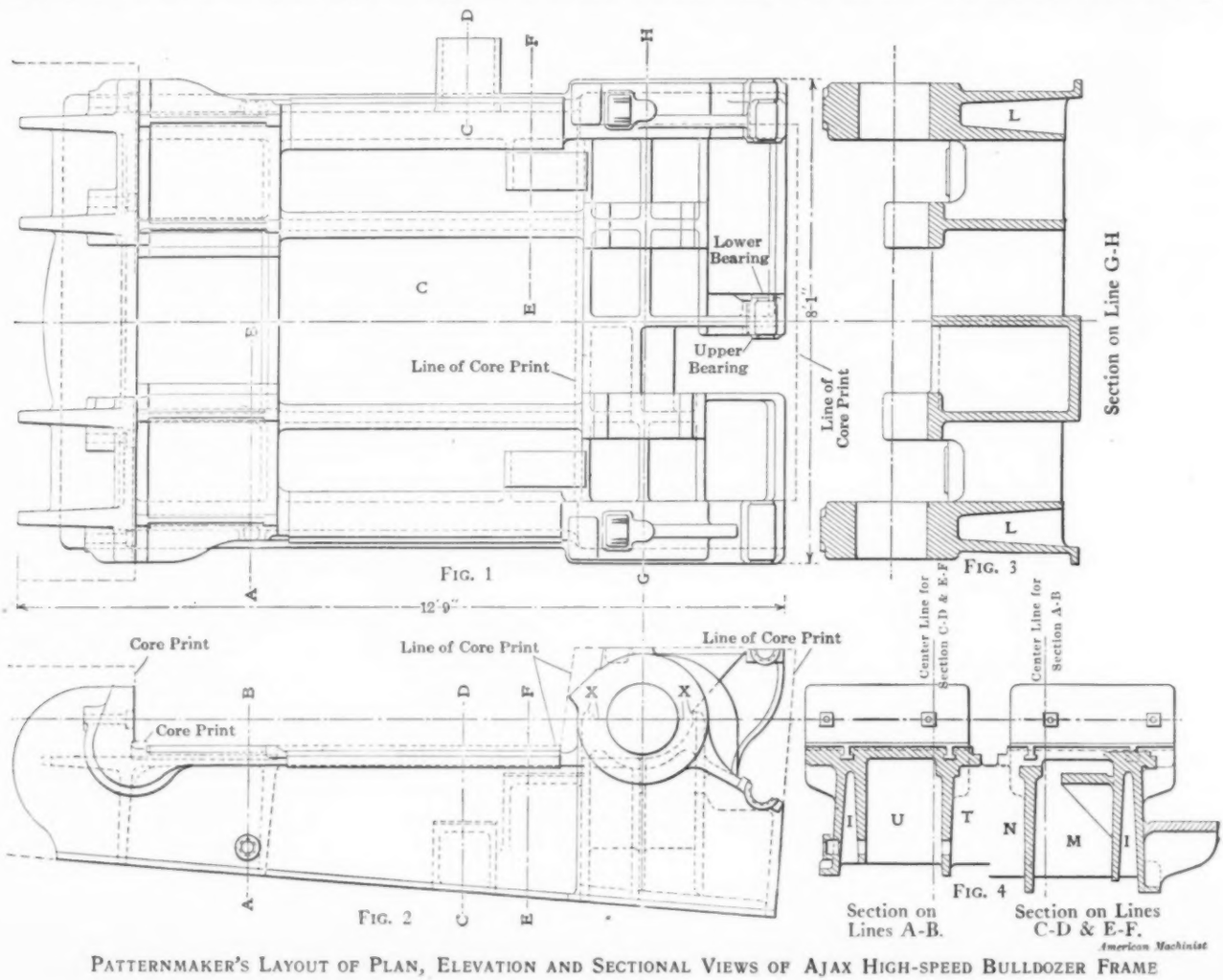


FIG. 1 FIG. 3 FIG. 2 FIG. 4

PATTERNMAKER'S LAYOUT OF PLAN, ELEVATION AND SECTIONAL VIEWS OF AJAX HIGH-SPEED BULLDOZER FRAME

warp in any direction and thus destroy the allowance on the finish surfaces can often be guarded against by the casting in of tie bars, or in other ways.

Molding Methods

The question of most importance is probably the manner or method of molding. The most economical method conducive with safety should be chosen. This demands a knowledge of the facilities and equipment of the foundry that is to make the castings. The ideal method is sometimes impossible by reason of lack of equipment, floor space, or some other consideration. Thus, some patterns that were better molded in a flask and rolled over, must of necessity be bedded in the floor. The patternmaker must provide for this in the construction of the pattern, as its shape, loose pieces and cores are often different.

The next question to decide before starting the pattern is the economy of time and material in the pattern shop, but the best means for the molder to produce a casting of maximum quality, with the minimum amount of labor and foundry cost, should always come ahead of this question. Accuracy of dimension, solidarity of metal, and appearance of the casting are essentials of quality.

Possible Future Changes.

Of course, the pattern-shop foreman does not like to add to the pattern-shop cost, in order to attain the best balance sheet in the foundry, but it pays in the end, even where the foundry is outside and you get castings at a contract price. In a special machine like the subject of this article, future possible changes must be considered, so they may be made as easily and inexpensive as possible.

In Figs. 1 to 4 are given a plan view, side elevation, and sections of the casting required. The position of the several cores is indicated by letters, and these correspond to the letters on their respective boxes, to be shown later. It being necessary to mold this pattern in the floor and owing to the possibility of future changes, the pattern was constructed as plain and with as few loose pieces as possible. While this added somewhat to the amount of core, making it was partly, if not altogether, offset by the simplicity in molding operations.

By changing a few cores and adding a few to the 40, or more, already required, a wider or narrower casting can be produced at small cost.

Patternmaker's Lay-out

In commencing the pattern work, the first thing required is a full size working lay-out; its advantage will be recognized at once by the patternmaker. There should be just as much and no more of this than is required for the work, and full advantage should be taken of it by all that are working on the job. Properly used it is a great time saver and especially is this so when the work is divided up among a number of men. Each one then does his part correctly, according to the lines laid down, and when assembled the parts are bound to fit. In this case the work on the core boxes began simultaneously with the work on the pattern.

For a working lay-out for this job two boards were used. On one was drawn a plan view as in Fig. 1, and the section Fig. 3. On the other a side elevation as in Fig. 2 with the two section views in Fig. 4. All the allowances were made for shrinkage and finish and the lines for the core prints were also shown. For convenience and to save floor space, the section views, in Fig. 4, were drawn so the center lines overstepped each other. Where any danger of confusion existed, red or blue lines were made to indicate the different sectional views. The position of the interior framework was shown on this lay-out as the work progressed.

Making the Frames

The lay-out completed, the next thing in order is making the frames. Of these there are eight, including the end frames, as shown in Fig. 5. The casting having inclined ways (better shown in Fig. 6), also tapering sides as seen in the sectional views, Figs. 3 and 4, care should be exercised in the building of these frames, in order that the same taper be maintained throughout. In fact it is always essential that this part of the work be accurate, as it is the foundation upon which the structure is raised.

In making the frame the correct method is to work from one center line throughout; the uprights first being laid on the side elevation lay-out at their respective positions and their length checked off from this. The center line should also be marked on them, or its distance from them noted. These outside uprights should then set far enough back from the lines on the end view to allow for the thickness of the outside board; 1⅜-inch stock being used, and the cross pieces securely fastened to them. Allowance for the outside planking should also be made in locating these. The center uprights are then fastened to the cross pieces and the frames all set to the correct line. They are then ready to have the planking screwed to them. This forms the box pattern and the boards act as longitudinal braces throughout the job. The construction of the interior frames is clearly shown in Fig. 5.

Fig. 5. Frames of Pattern in Position for Planking

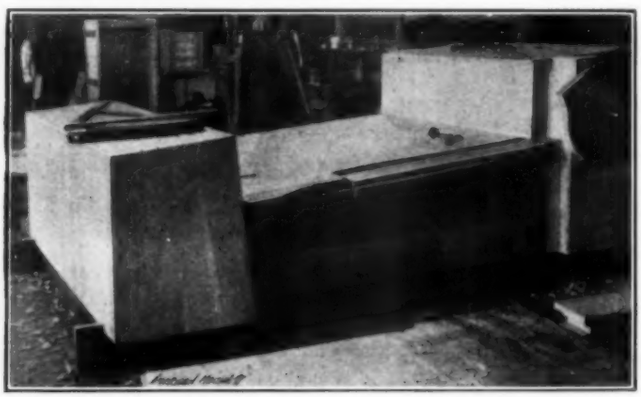


Fig. 6. Pattern and Main Core Prints After Planking

The end frames were boarded up while in position on the lay-out board and smoothed over before being removed. The planking was put on vertical with the lines of draft to give an easy draw to the pattern. This is good practice and should be done whenever possible, without impairing the stability of the pattern.

Level Bed on Which to Build Pattern

In order to build a pattern true, when as large as this, some kind of a level surface upon which to build it is necessary. A surface plate of this size not always being practical, the next best thing is shown in Figs. 5 and 6. Two pieces of 2x10-inch lumber, somewhat longer than the length of the pattern, were planed true on the edge. These were placed on the floor, the correct distance apart, and had three cross pieces of the same mate-

rial screwed to them. When leveled up, this formed a very satisfactory foundation upon which to build the pattern.

In Fig. 6 is shown the pattern after it is planked up, and the direction in which the grain runs. The loose parts are being fitted before rolling over and

The location of the feeding heads are marked with an X. The placing of these on a steel casting is essential and their most desirable location should be shown on the pattern. In some cases it is necessary that some metal thickness be added at some of these points to prevent

locates the center bearing for the same shaft, and *X X* are core prints for the oil-cup cores over the main-shaft bearing.

The reason for the offset in the main print at *Y* is to get the correct hight to the center of these bearings. It is car-

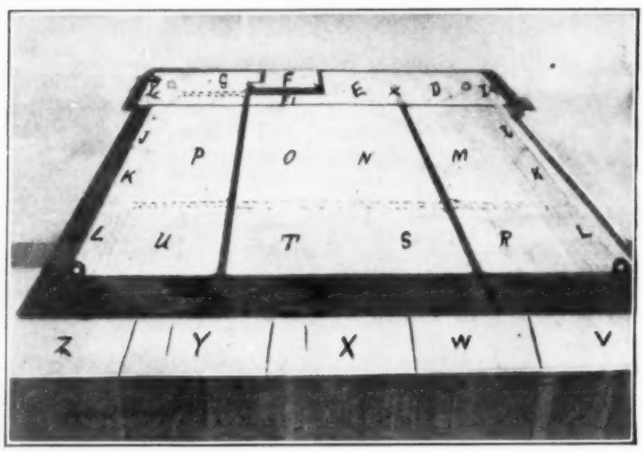


FIG. 7. BOTTOM OF PATTERN AS BUILT WITH CORES LINED OFF AND LETTERED

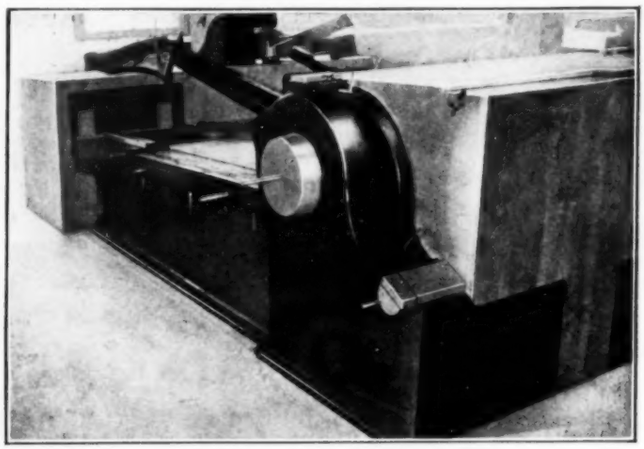


FIG. 8. COMPLETED PATTERN READY FOR THE FOUNDRY

the lifting straps, 6 in number, are shown resting on the core print. These were made of ½x2½-inch steel bar, and were hooked at the end about ¾ inch, according to the regular practice.

COPE SIDE OF PATTERN

In Fig. 7 is shown an inverted view of the pattern. This part is completed and the cores that cut through on this side are lined off and lettered. These same letters are given the respective core boxes and are used all through this article, as well as in the following one on molding.

the "freezing" of the head before the other metal is set.

COMPLETED PATTERN—REASON FOR OFFSET

In Fig. 8 we have a view of the pattern body completed. The loose parts for the near side are shown, pinned in place, while the parts for the opposite side are lying on the pattern. In this view *A* is pattern and core print combined, for the shelf bracket and core *H* underneath the bracket; *B* is part of the shaft bearing and supporting rib on the further side; *O* shows the core print that

ried throughout the full width of the pattern to avoid some changes in the core box for this part. In this core print, the distance from the center line to the right exceeds the distance to the left 3 inches. This is thrown off center so the core box can be made to take in sufficient of the supporting rib for the secondary-shaft bearing, to round off the corners, carry the necessary fillets, etc. This makes it impossible, or at least inconvenient, to arrange three of the cores of equal width; a stop-off piece being required for one of them.

(*Continued in next issue.*)

Converting an Old Planer

By Wm. F. Allison, Sr.

Some time ago I had to plane the faces of some machine parts four feet wide and too long to go between the housings of my planer. An overhanging tool four feet long was out of the question so I rigged up the planer as shown in Fig. 1.

FIG. 1. AN OLD PLANER CONVERTED INTO AN OPEN SIDE PLANER

Fig. 2 shows the two patterns made for the extension. The casting from *B*

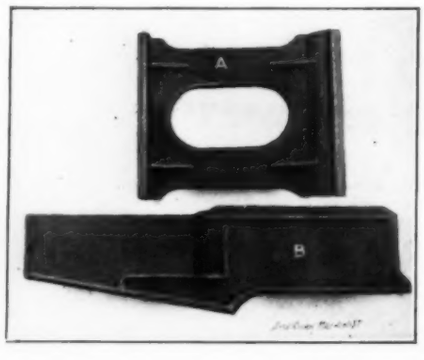


FIG. 2. PATTERNS FOR THE ALTERATION

had two sets of holes bored and reamed in it. One set matched the holes in the planer bed and the other matched the holes in the housing. The casting was long enough to set the housing back 21 inches allowing ample room for the castings I wished to plane.

The extension piece *A* supported one end of the crossrail and permitted it to be lowered to within 10 inches of the table. I made a good job of it, the planer seems to be just as rigid as it was before, and although I can change the planer back to its original shape in half an hour if necessary I have never done so.

A comparison of the world's fleets, omitting battleships and armored cruisers over 20 years old, shows Great Britain leading with 56 effective battleships, Germany next with 33, United States 30, France 17, Japan 14, Italy 10 and Russia 7.

Grinding Shafts and Shells

By H. Darbyshire *

The way in which an enthusiastic grinding machine man got into difficulty and suggestions which will prevent similar troubles.

Roughing, hardening and grinding shells and shrapnel

Here is a little job that caused a considerable amount of trouble of a sort that is by no means uncommon: The small shaft shown by Fig. 1 was a detail in some textile machine and put through in batches of 200 at a time. The shafts were of machine steel made from the bar in a turret lathe leaving 1/32 inch on the diameter for finishing, the 1-inch portion being afterward case-hardened, and they had to be interchangeable as regards size on the largest diameter within 0.00025 inch to fit an annular ball bearing. It had been the practice to straighten the shafts first and then finish the hardened portion by grinding in an old lathe with a grinding attachment fitted to the carriage, the soft portion being afterward finished in the engine lathe. By way of increasing the production a 6x32-inch plain grinder was put in for finishing both this and other work and the trouble that ensued was caused by a little change in the order of operations on this particular job.

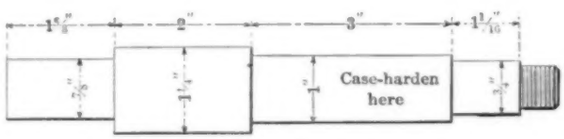


FIG. 1

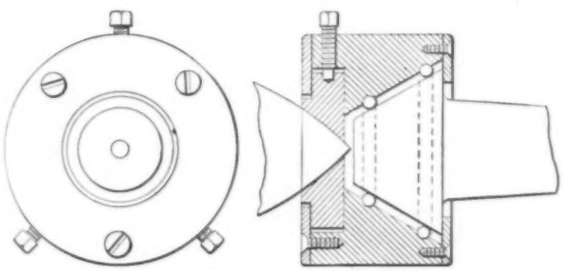


FIG. 3

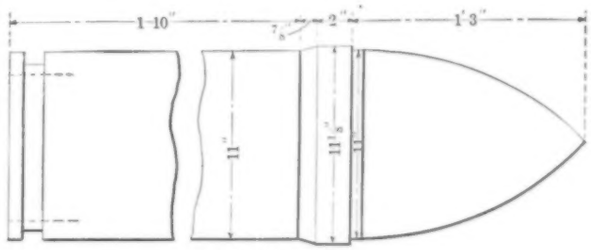


FIG. 2

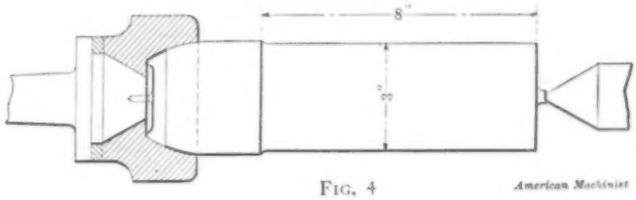


FIG. 4

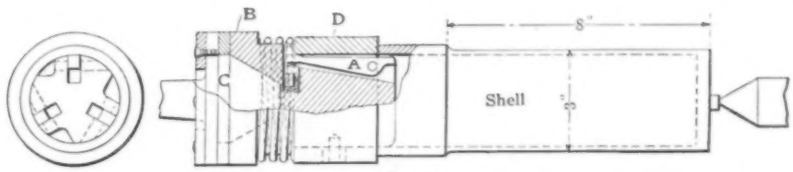


FIG. 5

GRINDING SHAFTS AND SHELLS

AN ENTHUSIASTIC OPERATOR

The operator (an enthusiast in his business) got a batch of 250 to grind and with the best of intentions laid himself open to make a record as to speed. He commenced by roughing down the largest diameter to within 0.0015 to 0.002 inch of finished size using the automatic feed. He had provided himself with a pair of driving dogs and while one was in process of roughing he affixed and unfixed a driving dog on another one, getting through at the rate of one per minute. When all had been roughed down on this part he treated the hardened portion the same way at the rate of 30 per hour following up with the two ends; these he roughed by means of a forming cut coming down to a fixed point on his index wheel, his time being some 40 seconds each.

TROUBLE AT THE FINISHING POINT

He trued his wheel up nicely and commenced to finish the hardened part, and afterward the two ends, by the same methods of feed as for roughing and taking a similar time, but found to his dismay that some 50 per cent. of the shafts would not clean up to size on the largest diameter. The reason, of course, was that he unthinkingly commenced on the job the wrong way and should have roughed the hardened portion first when all or most of the hardening strain would be removed. However, we all obtain our education by failure to some extent and both the operator and his supervisor recognized this. Since this occurrence he has revised his mode of procedure on many similar jobs and always attacks a hardened portion first; these particular shafts he is now getting out at a rate of 60 per day of ten hours.

PROJECTILE AND SIMILAR WORK

In the manufacture of projectiles, guns, etc., the grinding machine has come to be considered a very great economical factor. Its adaptability for rapid and accurate sizing makes it of peculiar value in the shrink fits which are a feature of modern artillery; wire winding when it exists is more easily ground than it can be turned and even the outside finish of a gun is more easily obtained by grinding than by any other means. Rifle barrels both for military and sporting purposes are now common food for the grinder in most establishments for the sizing and finish on their outer diameter, the peculiar curve of the latter being obtained either by an adjustment of steady shoes or by a former bar of the requisite shape. Both of these methods are modern features of the Norton machine which enable a tube to be accurately ground in three to four minutes.

GRINDING SHELLS

Since the introduction of the higher-grade steels for the making of projectiles, grinding even in its primitive form has long been found an economic necessity

*European demonstrator, Norton Grinding Company.

and in the Sheffield district the sandstone wheel has long been in use for the purpose, consuming an enormous amount of power and with a painfully limited grinding capacity. For hardened shells grinding is, of course, an absolute necessity and the means employed to grind one or two types of the shell may be of interest, this especially as the chucking appliances may be usefully applied for other purposes.

Fig. 2 shows a shell of large size which is hardened from the point well up to its ring and is ground on an 18x96-inch machine in an average time of 18 minutes. It is driven by means of a three-jaw chuck which grips the interior of the bore, the chuck being fitted with a plug to enable it to run on the headstock center; the other end of the shell is supported on a ball-bearing revolving center, Fig. 3, which has an adjustable shoe. This latter feature is found necessary because the points generally distort in hardening and it is a ready and convenient means of setting the shell true. Some 0.020 inch is ground from the diameter of the shell and the wheel is turned to form the small cone by means of a special device fitting on the footstock. The point of the shell is smeared with loose emery powder to insure its having a positive grip in the adjustable shoe. There was some little tendency to chatter in this job and this was attributed to the limited bearing surface. It is proposed that balls be dispensed with on the cone and a similar bearing to that for the smaller shells be provided with the addition of a ball-thrust collar. The chatter was overcome by fixing a wooden steady rest against the revolving center bush which acted as a cushion for absorbing the slight vibration.

Shrapnel Cases

Fig. 4 is a type of shrapnel shell made in a hydraulic press. The shells are first rough turned in lathes of a special type where about 1/32 inch is left for removal by grinding and 25 per hour are ground in a 10x50-inch machine. The method of driving may be clearly seen from Fig. 4. It consists of a revolving bushing running on a center pilot fitting in the headstock. The pressure of the supporting center insures proper drive and the shells are placed in position and removed without halting the work drive. The driving dog (not shown) is fixed on the larger diameter of the bush. A similar size of shell but of different type is shown by Fig. 5. Here the method of driving is, of course, different but the output is the same. The bore is not machined and is somewhat out of round but the variation from size does not exceed 0.010 inch. The drive is obtained from three triggers *A* fixed in a revolving steel bushing on a center plug *C* fitting in the headstock. The triggers are serrated and are expanded by means of a hardened sliding bush *D* which is rounded at the corner of the bore and which presses on the tapered heel of the triggers when the shell is placed in position; light springs below the heels of the triggers cause them to contract when the pressure is taken from the supporting tail center. Some little slip invariably takes place here when grinding commences but it is only momentary and the drive is found to be quite efficient. It will be noted that the corner of the revolving bushing is rounded so as to facilitate the chucking and removal of the shells after completion.

Limits and Finish on the Shells

The broad limit of 0.002+ and — is allowed on these shells which somewhat explains the rapid grinding; finish again is of no moment as they are afterward painted and as they are made of a hard quality of steel it is some trouble to get them rough enough to suit requirements, I have found that scoring the wheel occasionally with the diamond by hand, taking care to keep the wheel face flat, will give the corrugated appearance wanted and as the wheel wears smooth the process of scoring can be repeated. On the other hand some governments go to the other extreme and as they nickel plate their shells they demand a high finish which, of course, lessens the production somewhat.

In these methods of chucking work there is an excessive amount of tail-center pressure involved and I find a white-lead paste mixed with a few grains of graphite an excellent center lubricant, it answers well where heavy weights are carried either in the lathe or grinder and I have run jobs weighing a few tons, some 6 hours, without hearing a sound from the centers, the latter having the appearance of burnished silver when the job was removed.

Casting Bracket and Wheel Together

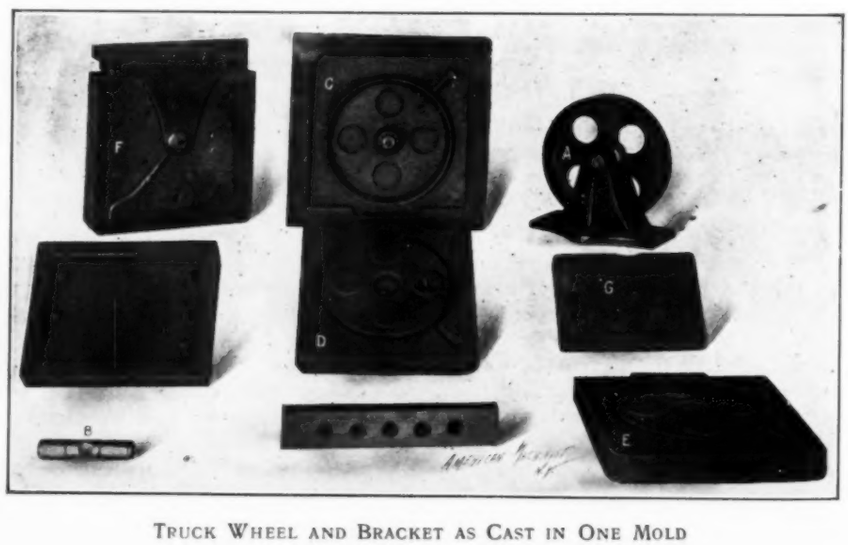
One of the novel feats that is accomplished in the foundry of the Whitcomb-Blaisdell Machine Tool Company is that of casting the bracket and wheel in one piece that is shown at *A* in the illustration. This leaves the foundry all ready to bolt to the truck for which it is made, and not a particle of machine work is done on it.

At *B* is shown the rod that acts as axle for the wheel. It has a hole ground in, as shown, so that the iron will fill it and keep the axle from turning in the wheel. The two ends of this pin, around which the bracket is cast, are covered with asbestos paper.

At *C* is shown a corebox with one-half the wheel pattern in it. In this are cast the two half cores *D* and *E*, and these are pasted together, after placing the rod axle *B* in position, to form the mold for the wheel.

A green-sand mold is then made over the pattern *F* and the core that contains the wheel mold is placed in this mold. After this, the slab core *G* is placed in the end of the mold to form the bolt holes in the flange of the bracket.

When the metal is poured in the mold, the casting shaken out, the sprue gates and riser broken off, and the asbestos paper removed so the wheel will revolve on its axle in the bracket, it is ready to bolt onto the truck, as shown at *A*.



Truck Wheel and Bracket as Cast in One Mold

Letters from Practical Men

An Interesting Drill Jig

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

The jig shown in Figs. 1 and 2 contains clamping devices of a novel character, which may be utilized in other jigs by making slight modifications in size and arrangement of parts. It is usually realized by tool designers and toolmakers that a jig should be so designed that the various clamping screws are readily accessible to the operator's hand without his being obliged to reach behind the jig or turn the jig around or perform various other feats that are sometimes necessary with poorly or carelessly designed jigs, for every unnecessary movement of the fixture or of the operator means just so much lost in the output of the device.

In the jig under consideration the piece being operated upon is a small steel detent plunger in which four holes are to be drilled which must bear a very accurate relation to the left-hand end cut on the plunger. These plungers are made both right- and left-handed, so that the jig must accommodate both styles.

hardened tool-steel posts *D* driven into the base against a shoulder and provided with clearance holes through their centers to let the drill and the chips come through the work.

The downward clamping of the work is accomplished by means of an arm *E* two dowel pins, which are driven into the base. The hardened tool steel V-clamp *H* sliding in the V-way in the hardened-steel block *J*, and operated by a right- and left-hand, nurled-head screw *K* serves to force the work against the locating block *G*. The square steel post *L* in which the screw *K* operates is driven into the base against the shoulder and retained by means of a thin hexagonal nut below the base.

The location of the end of the work against the block *G* is accomplished by the pressure of sliding tool-steel plungers *M*, which operate in the tool-steel blocks *N*, and which are normally pressed outwardly by springs *O*, but which are caused to clamp the work by the wedge action of the conical-ended nurled-head screws *P* which operate in the blocks *N*. The upper clamp is used when drilling left-handed detents, and the lower when drilling the right-hand detents. It will be noticed that the springs and plungers are well protected from the accumulation of dirt or chips, and may be readily removed

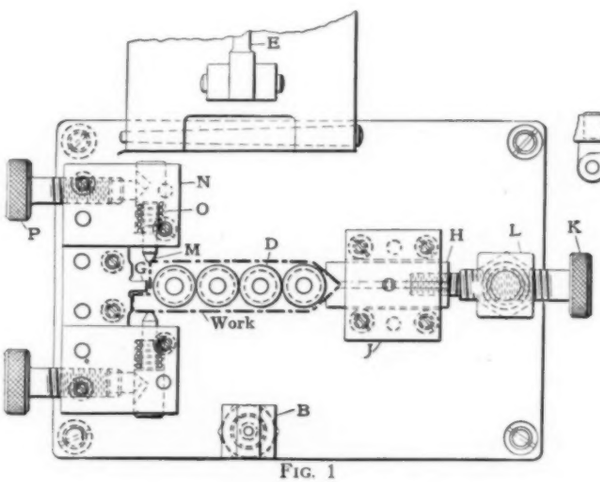


FIG. 1

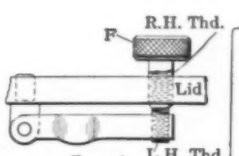


FIG. 3

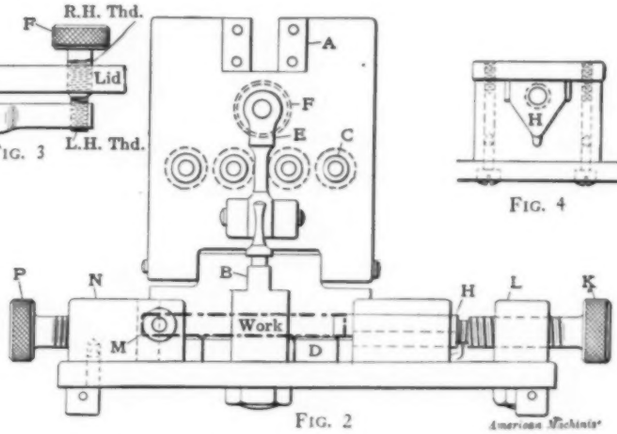


FIG. 2

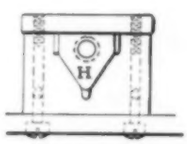


FIG. 4

A DRILL JIG WITH NOVEL CLAMPING DEVICE

The body and lid of the jig are made of machine steel, finished all over, and left soft. The lid is hinged on a tapered pin driven into the projecting ear on the jig base which allows the lid to turn on the pin, thus getting the largest possible bearing surface for the hinge, and it is also provided with hardened steel stop plates which take the wear caused by the blow received in closing the lid upon the locking screw post *B*. These stop plates are riveted to the lid.

The drill bushings *C* are of tool steel, hardened and ground, and are provided with large flanged heads to prevent drill-cutting the lid. The work rests upon four hinged to the lid at one end, and depressed at the other by means of a right- and left-hand, nurled-head screw *F*, Fig. 3, which not only makes the clamp quicker acting than would be the case with a single-action screw, but also does away with the necessity of providing a pivot in the end of the clamp for the screw to operate upon. The movement of this clamp is very slight and the operating screw is a loose fit in the lid so that there is no cramping action on the clamp.

The work is held against the hardened tool steel locating block *G* which is screwed to the base with two fillister-head screws from below and located with for inspection or replacement by simply backing out the nurled-headed screw far enough to allow the plunger to pass the conical end of the screw.

The jig is provided with hardened tool-steel resting feet, and also with a suitable lid stop to hold the lid in an open position just back of the perpendicular.

It will be noticed that the sliding clamp *H* retains its accuracy of alinement even after considerable wear, due to the fact that it slides in a V-way and that clearance is allowed on both sides of it above the V, as will be seen in the drawing, Fig. 4.

Cleveland, Ohio. C. NOSRAC.

A Rotary Milling Fixture

The sketch, Fig. 1, shows a rotary milling attachment which is designed for use in connection with a plain milling machine. It is mounted to revolve in a vertical plane so as to clear itself of chips readily and also to make use of a short-shank end mill, thus gaining the maximum rigidity which it is possible to obtain in the machine. The milling machine on which this fixture is used is equipped with a power-driven rotary table attached to a knee casting which slides on the column of the miller, and the fixture is located over a central stud and secured to the rotary table by means of two heavy cap screws, while two steel studs in the back of the fixture serve to impart to it its rotary motion, by engaging the rotary-table platen.

In Fig. 1, which shows a plan and side elevation of the fixture, *A* is a disk of cast iron machined all over and having mounted upon its front surface eight segment plates, *B*, of hardened tool steel, which are fastened by means of fillister screws and dowel pins from the rear of the plate and which have their front surfaces checked or roughened so as to give a good gripping effect when the work is clamped against them. The work, a sketch of which is shown in Fig. 2, is a gray-iron casting, finished on the surfaces marked *f*, and is located on its mating member by means of a tongue which enters the groove noticed at the bottom of the casting. This being the accurate point, the piece is therefore similarly located in the fixture, in order that the two parts may bear the proper relation to each other when assembled.

Eight hardened tool-steel locating blocks are attached to the face of the fixture by means of large fillister-head screws and dowel pins, as shown at *C* in Fig. 1. An L-shaped clamp *D* slides in a slot in the block *C* and has motion imparted to it by means of the nurled-headed screw *E*, which bears against the block *C*, thus causing the outer end of the clamp to pull the work firmly against the locating block by the hook action of the clamp behind a shoulder on the piece.

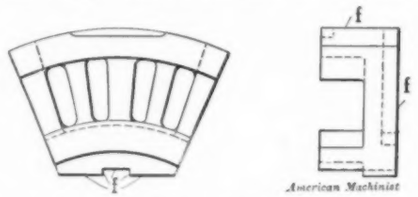


FIG. 2. THE WORK MACHINED ON THE ROTARY FIXTURE

The roughened plates *B* are recessed sufficiently to allow the end of the sliding clamp to travel freely backward and forward, besides serving to a certain extent as guides for it as well.

The work is clamped against the roughened plates *B* by means of hardened-steel clamps *F*, which are operated by square-head cap screws *G* and pressed outwardly by the helical springs *H*. These clamps are fitted at their outer corners with two conical spurs of hardened tool steel, which imbed themselves in the work and hold it rigidly in position. This is necessary on account of the thrust exerted by the milling cutter, when irregularities in the casting are encountered, causing the cutter to take a much heavier chip than usual.

The central hole in the fixture is provided with a hardened tool-steel bushing *K* and the fixture is fitted with two hardened tool-steel driving studs *L*, which will be noticed projecting from the back in the illustration. All screws and bolts are case-hardened to withstand the wear caused by repeated operation.

The square-head screws *G* are actuated by a T-handle socket wrench and the fixture is loaded while in continuous operation, by removing the work from the lower portion of the fixture and inserting new pieces which are easily located and clamped before they reach the cutter, thus enabling the machine to be driven at its maximum speed without any interruption of the cutting, except during the short interval consumed when the cutter passes from the edge of one piece to the front edge of the next.

Columbus, O. L. M. NORRIS.

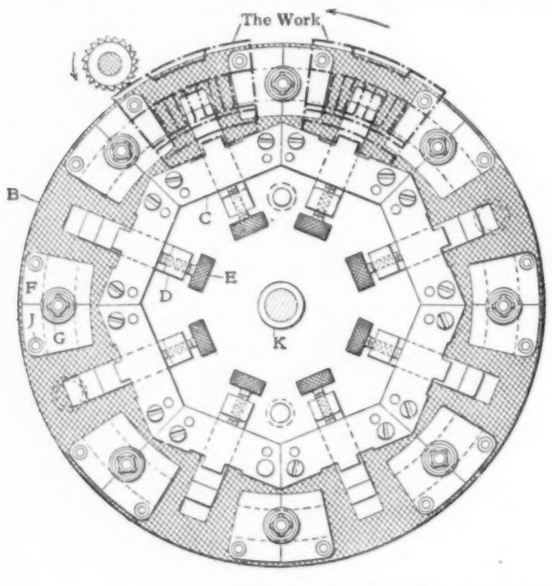


FIG. 1. ROTARY MILLING FIXTURE

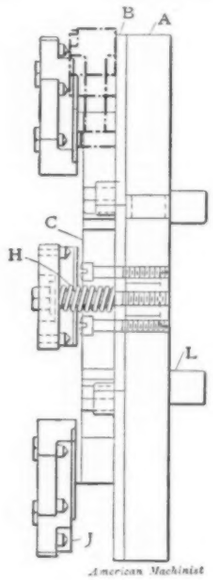
An Air Hammer—Machining Journal Boxes

At the Cumberland Valley Railroad Shops in Chambersburg, Penn., they have a very simple and effective little air hammer for driving out frame bolts and such work, shown in Fig. 1.

The body *A* is made of a piece of shafting to which the plunger *B*, also of machine steel, is fitted. The piston head *D* being larger than the hole in the internal flange *E* cannot be blown out when the air is turned on at *C* and there is nothing else to stop the plunger. A three-way cock handles the air pressure and exhaust from the cylinder.

Fig. 2 shows an old lathe rigged up for boring the railroad car journal boxes shown at *B*. These boxes are about 9 inches long and are bored to about an 8½-inch circle. The journal box *B* is secured by the two set screws *H* in the front of the jig *A*, the two set screws *I* at the back being used for adjustment only. The jig *A* is secured to the carriage which is provided with power feed.

The boring bar *G* carries three cutters *C* a roughing cutter, *D* a finishing cutter and *E* a sweep tool which finishes the



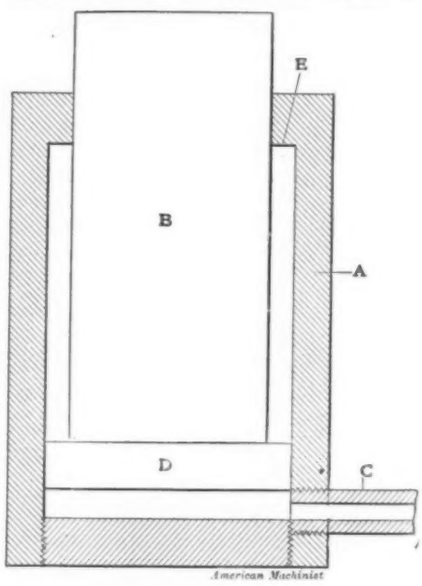


FIG. 1. AN AIR HAMMER

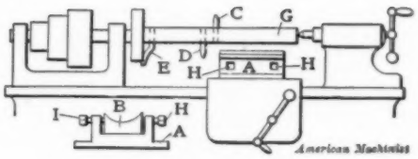


FIG. 2. MACHINING JOURNAL BOXES

end of the journal box after the finishing cutter *D* has passed entirely through. From the time the operator takes up one box until he takes up the next ready to insert it in the jig, a little less than three minutes elapses.

New York. E. A. DIXIE.

A Die Shifting Attachment for a Toggle Press

The line cut shows a die-shifting attachment, which I designed for some Ferracute coining presses, used in watch-case work.

This attachment was used on eight machines of that type, with every satisfaction to the firm and the operators. It possesses two advantages, namely; facilitates quickly charging the die and lessens the possibility of crushed fingers.

It will be noticed that the die holder runs between two guides screwed to the bolster and connected to the lever by an adjustable link, which is held in the lever by a snap pin *A*, which is more clearly shown in the small sectional detail.

This snap pin being always in shear, has little or no tendency to slip out and permits of quickly disengaging the die holder for changing dies.

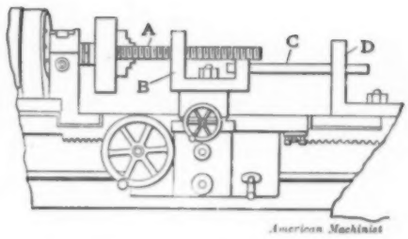
The cam *B* is of chilled cast iron, held by two set screws to the toggle-operating shaft of the press.

The spring attached to the counter-weighted cam lever prevents it from jumping on the sudden rise and assures an absolutely positive and regular motion.

Riverside, N. J. A. L. NACKE.

A Broaching Attachment for Lathe

This appliance will give good satisfaction on small work. It is simple and strong and can be made and attached to any lathe by any machinist. It consists of a one-inch screw *A*, one end of which is held in the chuck; the other end is threaded into the angle piece *B* which is fastened to the tool carriage. This angle



A BROACHING ATTACHMENT FOR THE LATHE

iron should be made strong, as the strain all comes at this point. The broaching tool *C* fits into a slot in the angle piece *B*; the other end slides through a hole in an angle plate *D*, which is bolted to lathe bed. Behind this the work is placed.

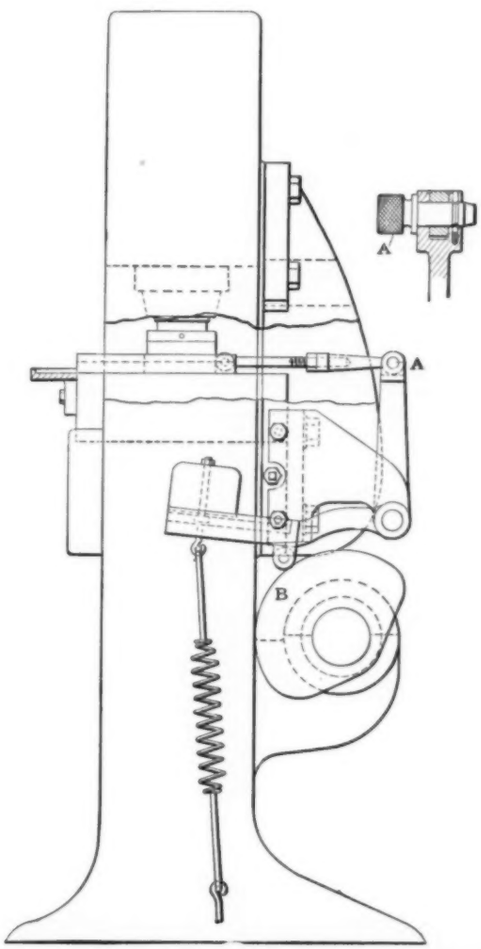
D. FOSTER HALL.

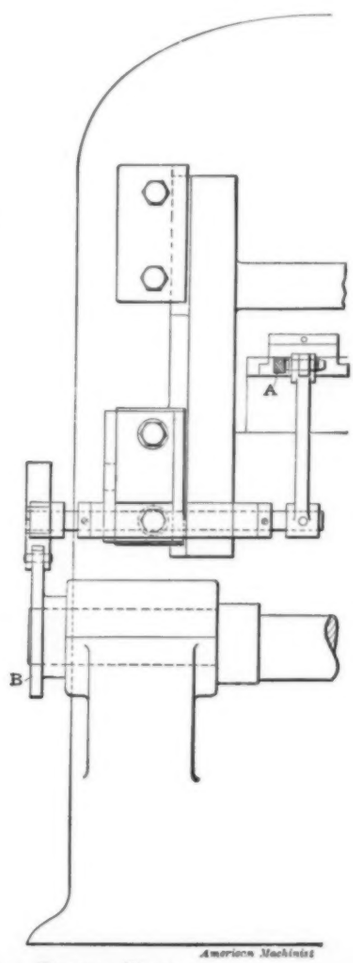
Springfield, Mass.

Friction Driven Stock Roll for the Punch Press

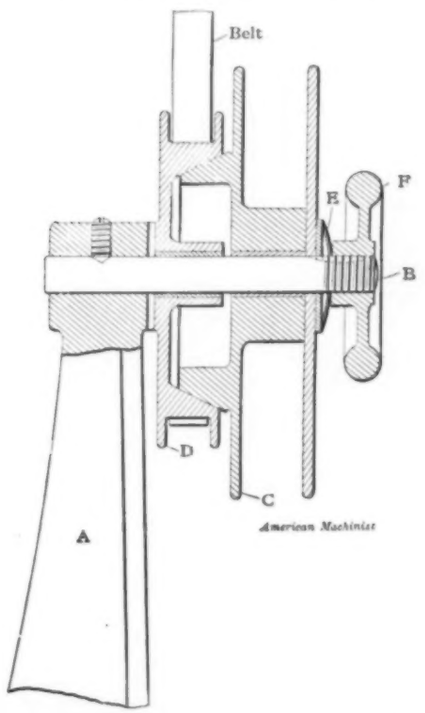
Where punch presses are fed with ribbon stock, and the operation of the press on one type of work is comparatively steady, it is not an economical practice to feed the stock to the presses by hand, requiring as it does, an operator for each press, although this is frequently, in fact, usually done. For the elimination of this condition, a fixture such as is here described may be used advantageously, enabling one operator to feed several presses in place of one, as it is only necessary to keep the press supplied with stock, and to occasionally adjust the tension on the friction reel.

The device is shown herewith where





A DIE-SHIFTING ATTACHMENT FOR A TOGGLE PRESS



SECTIONAL VIEW OF THE STOCK ROLL

A is a cast-iron base, provided with lag-screw holes, for attaching to the floor, and carrying at its upper end a stud *B* which serves as a central bearing for the cast-iron stock reel *C*, and also for the cast-iron driving pulley *D*, both of which are bushed with bronze bearing sleeves. It will be noticed that the pulley *D* is recessed at one side to form a conical friction drum against which the stock reel is forced by the pressure of the spring washer *E*, the tension of which is regulated by a corrugated hand-wheel *F*.

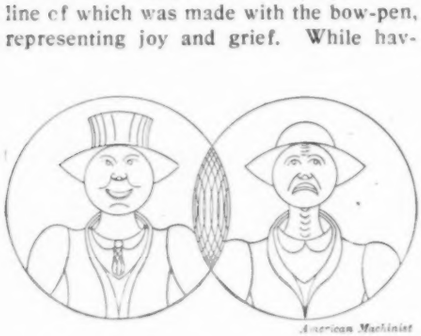
The fixture is mounted to one side of the press, and driven at such a speed, that when the reel is empty and the stock is just starting to coil upon it, its speed will be sufficient to give the stock the proper feed through the press between strokes of the ram. A retaining finger on the punch press serves to prevent the travel of the stock during the down stroke of the ram, during which time the friction drum on the pulley is slipping against the stock reel, but as soon as the retaining finger releases the stock on the up stroke of the ram, the reel immediately becomes operative, and feeds the stock through the press until stopped by the retaining finger falling back into the opening in the stock.

Several double-action presses which are constantly employed in the production of small sheet-metal cups about 5/8 inch diameter by 1/4 inch deep have been equipped with this style of friction stock feed, and are producing an average of 7000 pieces per hour, and require only one operator to tend them.

Toledo, O. A. H. JONES.

A Study in Curves

I am sending you a sketch (?) every line of which was made with the bow-pen, representing joy and grief. While having no practical value, it may interest some of the draftsmen who are readers of this journal.



A STUDY IN CURVES AS PRODUCED WITH THE BOW PEN (ORIGINAL SIZE 2½x4½ INCHES)

Along the crooked path of life
We meet with many curves;
Some make us laugh at toil and strife,
While others try our nerves.

R. W. J. STEWART.

Chattanooga, Tenn.

Paper Cutting Device for Clippings

The paper-cutting device represented by the accompanying prints may interest those of your readers who do much clipping from your columns or elsewhere.

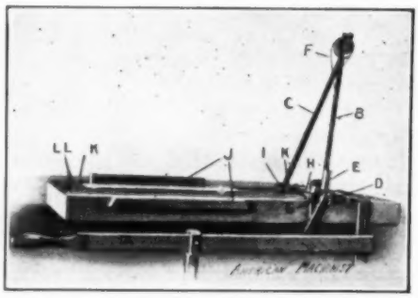


FIG. 1. CLIPPING CUTTER

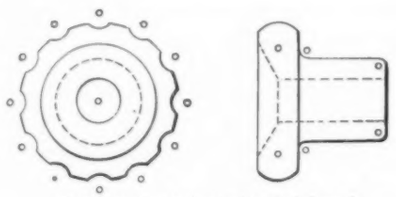


FIG. 2. KNIFE FOR CLIPPING CUTTER

As represented herewith, the device is designed to cut sheets of size equal to the pages of *Power* and AMERICAN MACHINIST.

The operation is as follows: The lever *A*, Fig. 1, may be operated either by hand or by foot (the light footrod having a stirrup-shaped end). The lever moves the bell crank *D* through a small angle, and, since the cranks *D* and *E* are fixed to a common shaft *H* (at something less than 90 degrees) a motion is imparted to the arm *B*, and, in turn, a straight line motion is given to the knife attachment *I*. The stop *G* fixes the travel of the knife attachment, and the spring *F* is of sufficient strength not only to cause such pressure as is required for cutting when the angle between arms *B* and *C* is large, but serves to bring the knife attachment back to its initial position.

Referring to this knife attachment as shown in Fig. 2, the knife travels between two cast-steel shear-strips, whose inside faces are slightly beveled. The knife is simply a steel disk beveled on one edge. The roller is made with a sleeve to take the knife and the necessary nut; *L L* are strips of wood along each side of the shear-strips, and beveled to let or cause the paper to slide up over.

This device is convenient for trimming small blueprints, but does not leave an edge entirely satisfactory to the photographer. Regarding its cutting powers, with the knife "touched up" with a file only (and when of size mentioned above) it will shear three sheets from your journal at once. Its greatest advantage, next to its speed is, probably, that which comes from using the gage *J*. By its use all clippings may be made in common sizes, for example, 2x4 inches, 3x6 inches, etc., and thus kept in better order than when cut to the size of each particular print or cut.

Ithaca, N. Y. R. MATTHEWS.

A Drill Jig with a Novel Clamp

During a recent trip through the factory of a large manufacturing concern, my attention was called to an ingenious clamping device that was being used to secure a flat brass cabinet door in a drill jig. The general construction of the jig and clamp is shown in Fig. 1. The piece operated upon is approximately 8 inches wide and 10½ inches long, and is of the usual shape given to metal cabinet parts. Holes are to be drilled in the two bosses shown on the left-hand end to enable hinges to be attached and several other holes at the right-hand end to accommodate a small knob and a locking mechanism.

In order to locate the piece accurately within the jig in the shortest possible time with the least amount of work, the following construction is used: The body of the jig, namely, the bottom and three sides are made of soft steel, machined all over, and provided with hardened resting feet on the bottom and right-hand end, as shown. Two hardened-steel locating blocks are provided at the left-hand end, and a hardened-steel strip is fastened to each side of the jig on which the piece may slide and rest. A soft-steel strap is screwed and doweled to the two sides, acting as a bridge in which to fit the drill bushings, and also two

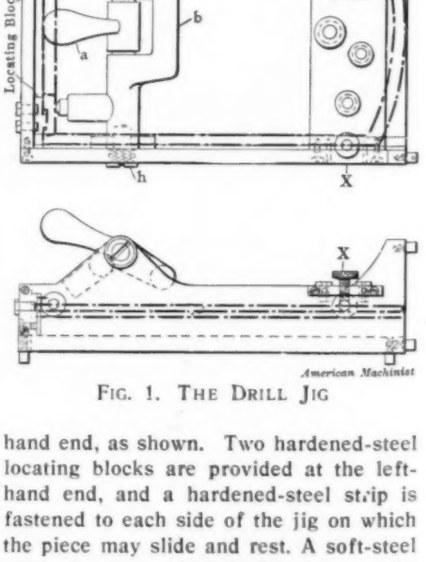


FIG. 1. THE DRILL JIG

nurled clamping screws which hold the piece down on the steel strip. Two clamping screws are also provided on one side of the jig to throw the casting over in the proper locating position.

The most interesting portion of the clamping mechanism, however, consists of the U-shaped rocking clamp and handle, a sectional view of which is shown in Fig. 2, in which *A* is a cast-bronze handle the right-hand portion of whose hub is threaded right-handed and the left-hand portion left-handed, into which screw the sliding wedge rods *C*. These rods are made of hardened tool steel, and are provided with a keyway

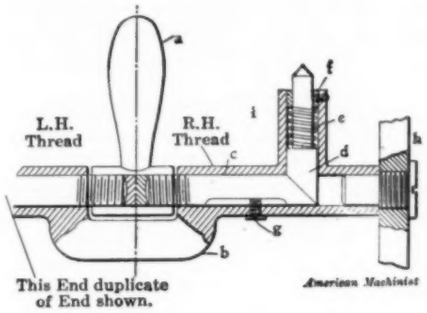


FIG. 2. SECTIONAL DETAIL OF CLAMP

into which the extremity of a small setscrew *G* projects to prevent the rod from turning. *B* is a bronze casting provided with two projecting bosses *I*, in which slide the wedge-actuated clamp pins *D*. These pins are spring-pressed inwardly by a helical steel spring *E* acting on the shoulder of the clamp pin *D* and reacting against the hardened-steel bushing *F* which is retained in the bosses by a small setscrew.

The casting *B* swings at each end on a hardened-steel shouldered screw *H*, which permits the entire mechanism rocking around its center line. In Fig. 1 in the lower view a pin will be noticed, which serves to limit the rocking travel of the clamp in both directions by the interference of small lugs cast upon the clamp *B*, and in the upper view a helical spring will be noticed, which serves to throw the clamp to its extreme downward position, as illustrated.

The operation of the device is as follows: Assuming that a casting is now clamped in the jig, the nurled screws *x* are first loosened, after which the handle *A* is thrown back until it strikes the casting *B*. This will cause the sliding plunger rods to be pulled in to the handle, permitting the clamping plungers *D* to be pressed back by their springs. As soon as the handle *A* strikes the casting *B*, the whole clamp rocks as a unit about its center, lifting the clamping plungers away from the bosses on the casting, thus permitting it to be withdrawn from the jig. A new casting is inserted in the jig and the handle thrown forward, the first effect of which is to allow the apparatus to rock back into its downward position, so that the clamping plungers land in the proper place, and then the sliding plungers are thrust apart by the screw action of the handle, causing the plungers to firmly secure the casting both with downward pressure and also with a pressure to the left, after which the nurled screws are tightened up.

It will be noticed that space is left between the ends of the handle hub and the casting *B*, in order that the clamping plungers may equalize the pressure to compensate for any irregularities in the casting. The device, as a whole, is very satisfactory, and it is probable that the principle involved is adaptable to many other fixtures.

Cleveland, O. J. K. CAREY.

What Should an All-round Machinist Know?

Some time ago, in response to an advertisement for an all around machinist, I had fourteen applications. The requirements were that the successful applicant should be a fair lathe, planer and driller hand and a steady worker. Out of the fourteen, nine men could not cut threads on the lathe, and of these nine men, five, and also two of the remainder could not do taper turning and boring. The other five men claimed to be first-class.

Regarding planing, all but three claimed to be able to do any job on a planer. In drilling, no less than five said they could not do any boring on a drilling machine. Thinking this over, I wonder what constitutes the necessary knowledge an all-round machinist should have, both from the employer's and employee's standpoint? A short time ago a friend of mine had occasion to write for a position of this kind. He was successful in getting it. He had several years' experience on lathes, planers, drilling and boring mills and also had a slight acquaintance with milling machines.

About two months after he had taken the position I was surprised to see him at my house one evening, as the place was over forty miles away. I asked him how he was getting along and he remarked that it was a splendid place to work, that since he had been there he had been on a lathe all the time and had succeeded admirably until that afternoon, when the foreman told him he wanted him to take a Brown & Sharpe universal milling machine and cut some special cams. This job required careful indexing and cutting and had to be very close as to measurements. He told me he was clearly stalled on this job and came up to see if I could help him out. He had sketched a plan of the job and brought it with him. Luckily, I had a copy of Brown & Sharpe's treatise on milling and indexing, and instructed him how to go about the job. I told him if he had the least doubt about not being able to do the job in the morning, to see the foreman and let him know that this was a part of the trade he was unaccustomed to, and probably it would be all right, as the foreman would show him and keep him straight.

I saw him later and asked him how he made out. He told me he had spoiled the first one and called the foreman's attention to it and had been instructed to try another one. This he had done successfully, also the rest, and had found out in the meantime that the foreman could not do the job himself. This struck me as being humorous, considering that the foreman criticized my friend about spoiling the first one and claiming that he had hired him for an all-round machinist.

GEORGE H. HANDLEY.

Newburgh, N. Y.

Wax for Metal Patterns—Making Plaster Casts

The following is a very good wax for metal patternmakers' use. Rosin, 1 part; beeswax, 1 part; plaster of paris, 1½ parts. Heat the wax and rosin and stir in the plaster of paris, then add lampblack to make the desired color. Apply this wax with a heated knife.

After taking an impression of a casting with plaster of paris, I find that by pouring vinegar around the edges, the plaster will loosen so that the cast can be removed without injuring it.

Harvey, Ill. F. E. L.

Machining Square Work in the Lathe

It is considered by some an impossibility to machine a piece square in a lathe without special attachments. Although it is not profitable, as a rule, it may be done to advantage when there is no other machine at hand.

Clamp a toolmaker's vise to the face plate, place the piece to be machined in it with enough projecting to permit facing off one side. Then place the finished side toward the fixed jaw and machine the next face. Continue in this manner until the desired result is obtained. If care is taken in clamping, the job may be done to a surprising degree of accuracy and in shorter time than most imagine.

A little judgment must be exercised as to the shape of the piece to be machined. Extra long pieces cannot be handled in this manner.

Hartford, Conn. H. H. ELLIS.

Machine Tool Builders Convention

The semi-annual convention of the National Machine Tool Builders' Association that met at Hotel Seneca, Rochester, N. Y., May 24 and 25, was well attended. President F. A. Geier called attention to change in the attitude of machine-tool builders toward each other, which had come about since the formation of this association, and the advantages of good fellowship, aside from the work done toward standardizing tools. He also urged a more careful study of the apprenticeship program as recommended by the committee on this subject a few years ago.

The committee on Standardization of Motors was represented by P. E. Montanus, who outlined the progress that had been made in securing the coöperation of motor builders. The sizes so far decided on are 1, 1½, 2, 3, 5, 7½, 10, 15 20 and 25 horsepower.

E. J. Kearney, of the Uniform Costs Committee was unavoidably absent, but heartily recommended the adoption of a uniform cost system so far as possible, and recommended that which was outlined for the association by Miller, Franklin and Stevenson which they are now using with entire satisfaction.

The Apprenticeship committee was represented by F. L. Eberhardt, who outlined a plan covering both two- and four-year apprenticeships. This includes a bond which is paid in weekly by the boys' parents and which is returned at the end of the term, this often being more convenient than the payment of a lump sum.

J. B. Doan, for the Tariff committee, outlined the comparative tariff duties, showing how they added to the cost of machines to the buyer in the different countries. He recommended the tariff commission called for by President Taft.

Four viewpoints of the cancelation of orders were given by C. Wood Walter, C. A. Johnson, Murray E. Shipley and William B. Reid. All agreed that the cancelation privileges were often abused by being used to secure delivery on the possibility of needing the machine at that time.

The session of the 25th opened with an illustrated address by Prof. F. B. Dyer, superintendent of the Cincinnati schools, showing the work that is being accomplished by their continuation schools in arousing the interest of the boys in their work and giving them the practical instruction which is so necessary and not always easy to secure. Much credit was given the instructor, J. Howard Renshaw, and his assistant for the success of the plan.

Many interesting suggestions were made by Robert Pierpont, manager of the Olds Motor Works, Detroit, Mich., in his paper on "The Future of the Automobile Business with Reference to Machine Tools."

The discussion between gear- and cone-driven tools by William Lodge and R. K. LeBlond ended in a general agreement that each type of machine had its field and that the careful shop manager selected his machine to suit the work in hand.

The plea for a bill to create a Patent Court of Appeal, by W. R. Wood, led to the adoption of a resolution urging the passage of bills now before Congress, which will accomplish this result.

The Wednesday afternoon session was largely devoted to the exposition of the merits of so called direct advertising and trade-paper advertising, by A. H. Hitchcock and John A. Hill.

Extracts from some of the papers will appear in our next issue, as they represent the latest thoughts in connection with the machine-tool industry and contain many suggestions which can be profitably considered.

No report of this meeting would be complete without an expression of appreciation of the work of W. P. Davis and the whole local committee, as well as of regrets that Mr. Davis was too ill to attend the meeting, for which he had done so much. Nor can the work of Secretary Hildreth in securing new members and the program committee in arranging for the excellent papers, escape without suitable commendation.

Last, because it was not a part of the business of the convention, but by no means least, was the hospitality of Miss Kate P. Gleason and her father, William H. Gleason, assisted by E. Rivett, in the excellent dinner provided at their charming Spanish villa in Pittsford, a suburb of Rochester. All members, ladies and guests fully concurred that the resolutions which elected Miss Gleason to honorary membership in the association were appropriately presented.

Railroad Pensions Reduce Need of Charity Organizations

A recent statement by W. Frank Persons, superintendent of the Charity Organization Society of the City of New York, contains the following:

"On consulting the records on file in this office we find that there were 3159 families who received care during the period intervening between October 1, 1909 and March 17, 1910. Of this number there were but five families where the men had been employed by railroads. The cause of application in two of these families was the death of the husband and father. In one, the man had deserted his family and in the remaining two cases, the families were in distress because of the serious illness of some member which had resulted in heavy indebtedness."

Inasmuch as the latest available statistics from the Interstate Commerce Commission report 1,458,244 persons on the pay rolls of the railways of the United States, or about one-twelfth of the total wage-earning population, the surprising statement of Mr. Persons that only about one six-hundredth of the appeals for assistance to the Charity Organization Society came from the families of railroad men, is significant of the beneficent character and successful operation of the pension systems now being maintained by the various railroads.

Springing of Castings

A manufacturing concern which had suffered severely from the springing of thin stove-plate castings, evidently during the cooling of the metal in the molds, instituted a very searching inquiry as to why all the castings did not come out of the sand true, or all come out bent or twisted. They argued that there must be varying conditions in the foundry as some of the castings were absolutely perfect, while others were fit only for scrap.

After very searching inquiry, and the making of many experiments, it was decided that nearly, if not quite all the trouble was caused by an uneven mixing of the different kinds of iron used in pouring the thin castings in question. It was claimed that some of the iron came down quicker than some other kinds, that a ladleful might contain two or three kinds of iron only partially mixed together, and that the pouring of various portions of the molds with these different mixtures, and half mixed kinds of iron, would and did cause the trouble.

It was recommended that, other methods failing to cure the trouble, the iron be melted in very large quantities, drawn off into the largest ladles available, and from thence run into pigs, said pigs being remelted and used for pouring the castings. The cure might be an expensive one, but perhaps not so much so as the constant loss of 10 per cent. of all the castings made.

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American Machinist

Editorial

Inspection of Ceiling Fixtures

The countershaft is an important, often much abused and sadly neglected appurtenance of the majority of machine tools. The reason for its neglect undoubtedly lies in its position. It is hardly the "path of least resistance" to care diligently for a mechanical device located 10 or 15 feet from the floor, while the caretaker is perched upon a more or less insecure ladder and surrounded by quickly traveling belts and rapidly rotating pulleys. This neglect the countershaft shares with the line shafting and other ceiling fixtures, together with the harness work that supports them all.

That proper care should be given to these fixtures no one will deny, and that it is not done is shown by the shutting down of tools for overhead repairs, hot countershaft boxes, line shafting out of line and level and vibration and shaking of various parts of the ceiling harness work. As a general rule, wooden stringers in some form are used to support the countershafts. In the dry hot air just beneath the shop ceiling the wood seasons, shrinks and checks quickly, and as a result the bolts for attaching these stringers to the building itself and the bolts for fastening the countershafts to the stringers become loosened and may in fact be in a condition that is positively dangerous.

We know of a few plants where there is an adequate inspection of all of these ceiling fixtures, but we believe that this inspection is not nearly as widespread as the conditions demand. In the case referred to, the inspection is made weekly and a signed report handed in to the superintendent's office. This is a wise provision, although the extent and frequency of the inspection would have to be determined upon from all of the surrounding conditions.

Besides caring for the work already in place such inspection should watch out for points of possible danger where safeguards are needed, such as pulleys set so closely together that a belt may run between them and pull down its countershaft, the passing of a heavy belt over a bench or passageway where its breaking might endanger persons working or passing beneath, and the like.

From all viewpoints such inspection is highly desirable.

A Coming Talking Point in Selling Machinery

Presently we will see the provisions for safeguarding operators dwelt upon as one of the "talking points" or excellent features when selling machinery. Already a certain amount of stress is being laid upon these safeguards, but the practice is by no means general. We welcome the day when it will be more common.

To prove the truth of the opening assertion, we have only to show the demand for it among buyers of machinery. Here is an instance:

The purchasing agents of the United States Steel Corporation have a rubber stamp with which the following notice is stamped upon correspondence: "Provisions for safeguarding workmen should be brought to our attention, as we will consider them in selecting new machinery and equipment."

Furthermore, a contract for a mill to be erected by one of the subsidiary companies of this corporation contained this provision: "Safeguarding of gears, spindles, couplings, collars, screws, keys, etc., will be covered as fully as possible in the drawings which we furnish, but it is understood that these features shall be subject to the approval of our inspectors, who shall have free access at all times of machinery while it is in process of construction and erection."

Working vs. Destructive Tests

The struggle between the steel makers and the machine-tool builders has produced some interesting, and at the same time, some discouraging results—interesting because of the achievements which have been shown to be possible, discouraging because of the apparent lack of appreciation of the fact that there should be coöperation instead of antagonism.

Some of the machine builders seem to consider only the destruction of the tools instead of the way in which to secure the most work from them, and so called tests are often made with only this in mind.

Taking the drill as an example, we find reports of tests where every drill was either broken or burned, although neither of these necessarily condemn the drill in question.

Any drill can be burned by running it too fast and with a very fine feed, just enough to keep it in contact with the metal. And any drill can be broken by running at too slow a speed and too heavy a feed. But neither burning nor breaking are useful, except as to know what to avoid.

What is wanted is real information as to the speeds at which drills or other tools can be run to produce the most work without injuring the tool.

In the case of drilling machines, perhaps more than other machines, it seems advisable to supply a table giving the best general speed and feed for each size of drill within its capacity. Modern drilling machines are supplied with plates which show the speeds and feeds which can be obtained. But they rarely connect these with the drills used and we too often find speed and feed combinations which are altogether wrong.

Drilling is a much more important operation than many realize, and the sooner we know and adopt the best working conditions, the better for our peace of minds and our pocket books.

A Possible New Material of Construction

On page 983 we presented a few facts in regard to the physical tests of ductile tungsten wire, reported from the research laboratory of the General Electric Company. The results are of sufficient interest to warrant a moment's consideration. It is possible that they foreshadow a new material, or metal, of construction for severe service. The average tensile strength per square inch ranged from 460,000 to 610,000 pounds; that is, the lowest average strength greater than the maximum strength of the best piano wire, and the average maximum strength is 150,000 pounds more.

In addition to this enormous tensile strength, the metal is extremely permanent under ordinary conditions; that is, it retains its luster almost indefinitely. The ordinary acids attack it very slowly, and tests are reported where fine wire has been heated for many hours in acids with only a very slight loss of weight.

Heretofore it has not been considered possible to produce ductile metallic tungsten, and no information is available as to what process is necessary in order to work it into this form. Accepting the fact that it can be produced in the form of wire of enormous tensile strength, two other factors must be looked into—the demand and supply.

We are assured that there are large bodies of tungsten ore already known, and that there are no serious difficulties in reducing these ores and producing metallic tungsten. At present but very little of this metal is produced, and the price is comparatively high, because there is very little demand. There have been numerous instances where the demand for a mineral product has disclosed enormous supplies of the necessary raw materials and has brought about development of processes whereby the cost of production was reduced and the final material put on the market in large quantities and at a reasonable price. If a demand arises for metallic tungsten, unquestionably that demand will be met and at a price within reason.

The important fact now is, metallic tungsten has been produced in the form of ductile wire of enormous tensile strength. It is possible that when tungsten alloys are carefully studied we will be again surprised by some of the results disclosed.

NEW PUBLICATIONS

THE ESSENTIALS OF LETTERING. By Thomas E. French and Robert Meiklejohn. Cloth, 72 pages, 6x9 inches, oblong, 85 illustrations, including plates. Varsity Supply Company, Columbus, Ohio.

This is the second edition of a manual prepared by Professors French and Meiklejohn of the Ohio State University, as an introduction to the subject of lettering, for students who will have to use letters on drawings or in designs. As the authors state in their preface, "There is no engineer's lettering as distinguished from other lettering. There is simply the adaptation by each draftsman of the style suitable to his particular needs. The map draftsman, the architectural draftsman, the machine draftsman, will each select appropriate letters for his kind of work." Draftsmen in these various lines should find the book of interest and a real help in training the hand and eye in the construction of different classes of letters and their composition or grouping into words and sentences.

Interesting School Exhibit of Machine Work

A recent exhibit of machine-shop work done at the Hebrew Technical Insitute of New York city gave evidence of industrial education practically applied.

This school has developed a three years' general course, including instruction in machine work, instrument making, tool making, wood work, pattern-making, applied electricity, mechanical drawing and applied mechanics, with a specialization in any of these branches during the third year, aiming to turn out boys equipped to readily adapt themselves to manufacturing conditions and commercial work.

Unlike its name, the school is entirely nonsectarian, and offers free tuition. Its annual maintenance expenses are about $56,000, met by private contribution.

Design of Hydraulic Press Cylinders

Our attention has been called to two typographical errors on page 579, in connection with Lamé's and Barlow's formulas for thick cylinders.

Lamé's formula should read

$$T = r\left(\sqrt{\frac{S+P}{S-P}} - 1\right).$$

Barlow's formula should read

$$\frac{S}{P} = \frac{r}{T} + 1.$$

The errors were in the radical sign in the first formula, and in the plus sign in the second.

PERSONAL

Albert B. Bowman has been appointed special representative of the Pawling & Harnischfeger Company, Milwaukee, Wis.

Grant D. Bradshaw, who formerly conducted a consulting engineering practice in Chicago, has become assistant steam engineer of the Cambria Steel Company, Johnstown, Penn.

E. W. Dean, until recently mechanical engineer with the Kiddee Press Company, Dover, N. H., has taken a similar position with the United Printing Machinery Company, Boston, Mass.

Gorham C. Parker has resigned his position as sales manager of the William J. Smith Company, New Haven, Conn., to accept a similar one with the Ready Tool Company, Bridgeport, Conn.

H. G. Baker, designer of textile machinery, has become associated with the Rhode Elevator and Machine Company, Providence, R. I., and will be engaged on a special line of textile machinery which this company is developing.

A. C. Brown, who has had charge of the tool department of the Remington Arms Company, Ilion, N. Y., for the past four years, has accepted the position of superintendent of the Denver Rock and Drill Machinery Company, Denver, Colo.

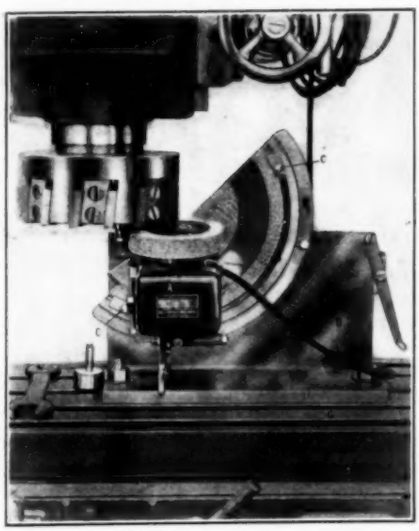
Henry Buker has been appointed western representative of the Brown & Sharpe Manufacturing Company, with headquarters in Chicago, following the absorption by this company of the business conducted by F. A. Rich. Mr. Rich remains connected with the Chicago office.

B. Oates, mechanical engineer, has resigned a position as jig and tool designer with H. R. Worthington, of Harrison, N. J., to accept a responsible position on the staff of the Fawcus Machine Company, of Pittsburg, Penn. He takes up his new duties the latter end of June.

New Tools and Shop Appliances

A Portable Cutter Grinder

The halftone shows a cutter grinder built by the H. C. Williamson Engineering Company, Indianapolis, Ind. The grinder is self contained and is intended for grinding milling cutters in place on the spindle. The motor *A* carries on its spindle a six-inch cup wheel. It is mounted on a base having a fixed angle of either 5 or 7 degrees to give the tooth the proper clearance. This base is secured to the plate *B* and can be moved upon it, in the arc of a circle, to present the wheel to the teeth of the cutter at any angle. Two stops *C* are provided for the horizontal and vertical positions.



PORTABLE CUTTER GRINDER

The plate *B* is secured to a horizontal slide *E*, operated by the hand lever *F* in the angle plate *D* secured to the table of the machine. The lever *H* is used for carrying the wheel up to the tooth for grinding and is provided with a stop so that each tooth is ground exactly the same.

File Tang Swaging Machine

A swaging machine embodying certain features not common to those already on the market has been brought out by the Coulter & McKenzie Machine Company, Bridgeport, Conn., which is the invention of Andrew Berg. The first type of machine produced under his design weighs about 4000 pounds, is 5 feet high, occupies a floor space of 2x4 feet, and has a power consumption of five horsepower. The machine is designed to produce file blanks.

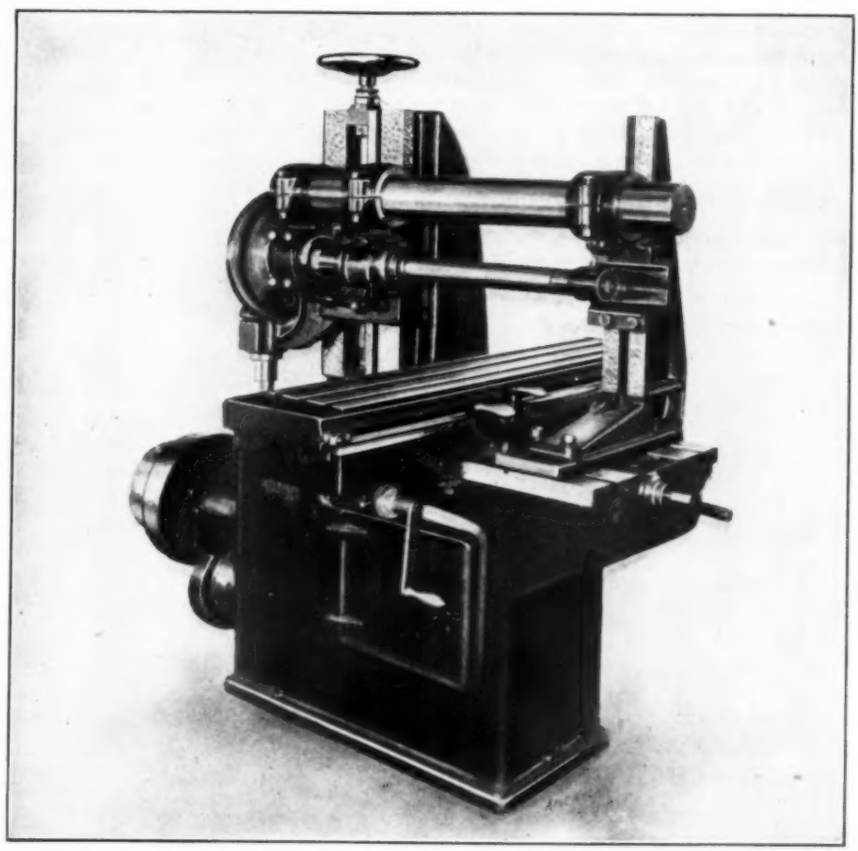
ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

A Horizontal Milling Machine

The halftone shows a new horizontal milling machine built by J. E. Reinecker, Chemnitz, Germany, and handled by the Carpenter-Kerlin Gear and Machine Company, 77 White street, New York. The machine is intended for that class of work usually handled on a Lincoln milling machine.

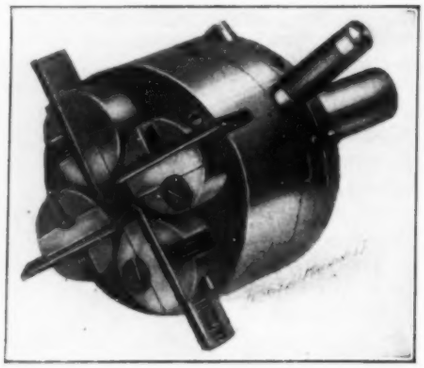
The table is driven by a worm running in a half nut the full length of the table. This half nut is made of tool steel fitted to the bottom of the table. The table is 39¼ inches long by 8 inches wide. Power feed of 35½ inches is provided for the table, which also has a crossfeed of 7⅞ inches. Minimum distance from the center of the spindle to the table, 2 inches; maximum distance, 13¾ inches. Gear ratio pulley to spindle, 1 to 5.5. The spindle speeds vary from 32 to 63 revolutions per minute. Eight gradations of feed are provided ranging from 0.157 inch to 7⅞ inches per minute, and the machine weighs, complete, about 2750 pounds.



A HORIZONTAL MILLING MACHINE

New Open Die

The illustration shows a new open die manufactured by Bickford & Washburn, Inc., of Greenfield, Mass. The main body is a solid piece of steel bored to receive the cylinders or chaser holders. Short



NEW OPEN DIE

arms at the back ends of the cylinders carry pins operated by slots in a cam plate, for opening and closing the die. A tangential screw shown on the upper rear edge of the body, stops the rotation of the cam plate and by adjusting this screw, the closed size of the die is determined. The small knob shown controls an eccentric sleeve which strikes the tangential screw, allowing a thick or thin part to come against the latter, so that by making a first cut with the knob in the position shown, a light finishing cut may afterward be taken. The chasers are held down by a beveled clamp and adjusted by a short section of screw, working in a hobbed thread at the back of the chaser.

A Billet Rotating Mechanism for Forge Shop Cranes

The halftone shows a device for the above purpose designed by the Johnston & Jennings Company, Cleveland, Ohio.

It is of heavy design to absorb the shocks without damage, and is entirely universal in operation. The billet or sling chain can be swiveled entirely around and all joints in the hook block are universal. It does not prevent obtaining any motion or hoist that can be obtained with the ordinary crane.

The motor does not receive any shocks due to hammering, nor can the motor be injured by the billet being fast or refusing to rotate. It is operated by the crane man either at the base of the crane, or the crane and rotator controllers can be located near the hammer man's position. It is designed to operate with electric power, although steam can be used if desired.

A Perforated Steel Belt

Fig. 1 shows a series of perforated steel belts which have been brought out by the Brown Spin-Wright Construction Company, 32 Union Square, New York.

These belts are spring tempered, about 1/32 inch thick. The one shown at *A*, Fig. 1, is 1 inch wide, the sprocket with which it runs is shown at *A*, Fig. 2, over the teeth the sprocket measures about 1¼ inches. Style *A* drives the sprocket shown up to 5000 revolutions per minute; above that it is inclined to jump out of contact and slip. *B*, Fig. 1, runs all right at all speeds, but the sprocket *B*, Fig. 2, is said to be difficult to make.

C, Fig. 1, runs well at all speeds, but has some slight defects. The sprocket for it is shown at C, Fig. 2. This sprocket is made in halves, the one part being formed on a body and the other part sliding on a spline on that body, as shown at *D*, Fig. 2. The object of this is to allow the sprocket to accommodate itself to any slight irregularity in the spacing of the holes in the belt.

D, Fig. 1, runs at any speed, from 100 to 20,000 revolutions per minute, without noise. The sprockets for *D* are about the same shape as for *C*. This style is said to carry any load the belt will pull.

E is a modification of *D* with extra holes on the edges to engage pins on the driving pulleys.

The method of drive is shown in plan at Fig. 3. *A* is the driving pulley and *B* the idler. The sprockets *C* are spaced as desired, so that their teeth engage the belt *D*. The writer saw one of these belts driving cotton spinning spindles at a speed of over 8300 revolutions per minute, practically without noise. While these belts have so far been used for textile machinery only, there is no reason

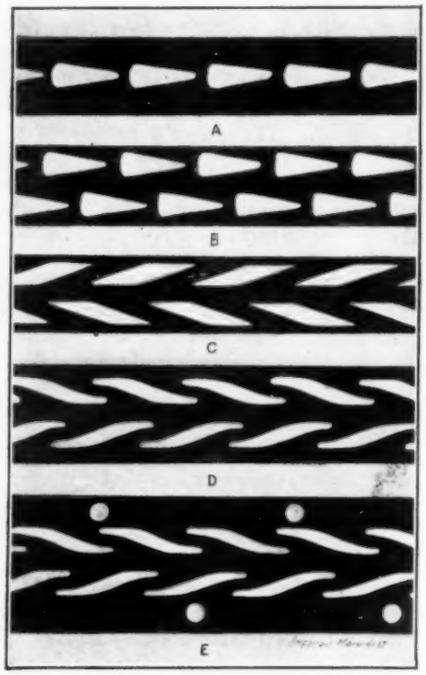


FIG. 1. PERFORATED STEEL BELTS

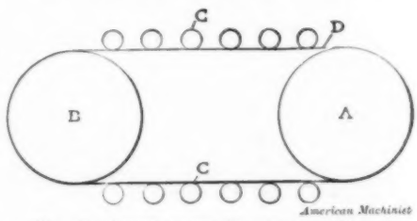
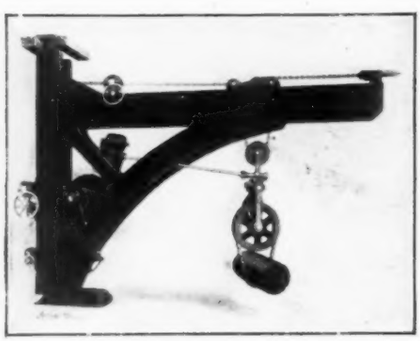


FIG. 3. METHOD OF USING THE BELT

why they should not be applicable to many other types of drives.

About a year ago an article was published in the AMERICAN MACHINIST, comparing the relative efficiencies of plain steel belts, leather belts and rope drives, in which it was pointed out that the



A BILLET ROTATING MECHANISM FOR FORGE SHOP CRANES

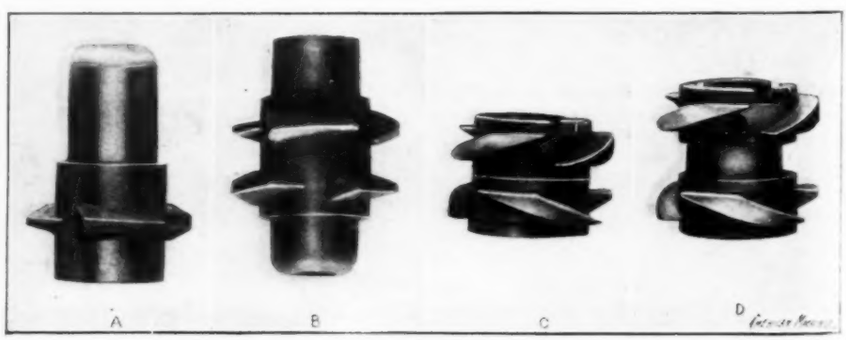
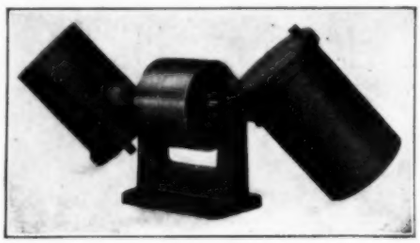


FIG. 2. THE SPROCKETS

efficiency of the plain steel belt was very high, always above 99 per cent., the slip not exceeding 0.15 per cent. The plain steel belt, however, can only be used on pulleys of comparatively large diameter while the perforated belt can, owing to its tangential drive, be used on pulleys of any size and with absolutely no slip.

Bench Tumbling Barrel

This bench tumbling barrel is made in three sizes by the E. C. Bliss Manufacturing Company, 91 Sabin street, Providence, R. I.



BENCH TUMBLING BARREL

The machine is designed for bench use for finishing, polishing and burnishing with the use of steel balls in an economical and efficient manner.

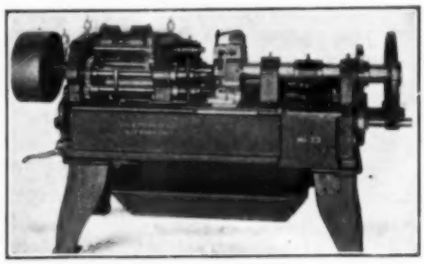
Patternmaker's Tool Case

The illustration shows a specially designed tool case which was seen recently in the pattern shop of the Wheeler & Scheible Company, Indianapolis, Ind. It was designed by and built for one of their patternmakers, William C. Von Burg, and as can be seen, it is very compact as well as complete. It is about the size of an extra large suit-case, is very substantially built and the arrangement of drawers, trays, and compartments, hardly needs explanation. In addition to the handle, a heavy strap is provided, which hooks into the rings shown at the end near the bottom. It will be noted that the tray containing the bits is provided with a cover, which can be fastened by the small snap straps shown. There are also two other snap straps fastened to the case itself, which hold the tray in position, no matter how the tool case, as a whole, may be tipped. This may contain a suggestion for other tool cases, which can be modified to suit other conditions.

Double Tapping Machine

In the accompanying illustration is shown a modification of the standard five-spindle automatic, manufactured by the George G. Prentice Company, New Haven, Conn. It is designed for drilling, tapping, etc., of castings and forgings. This machine has five spindles, two of which are geared together and driven from one pulley, provided with reversing friction clutches. The other spindles are driven from a separate pulley. The two spindles which are driven by the frictions are for tapping; the first of these is for rough and the other for finish tapping; this two-step operation being of advantage in saving breakage of long taps of small diameter. The other spindles are for drilling, counterboring, etc. It is specially proposed also, to split the drilling operation between two spindles similar to the tapping operation, but in this case, to cut the time of drilling in half. The machine is adaptable for drilling and tapping up to 5/8 inch diameter. The chuck has six sections, one section being used for placing the work in the fixture.

A new feature being applied to these machines is a differential-feed mechanism for speeding up the indexing time of the chuck. This is claimed to increase production about 30 per cent.

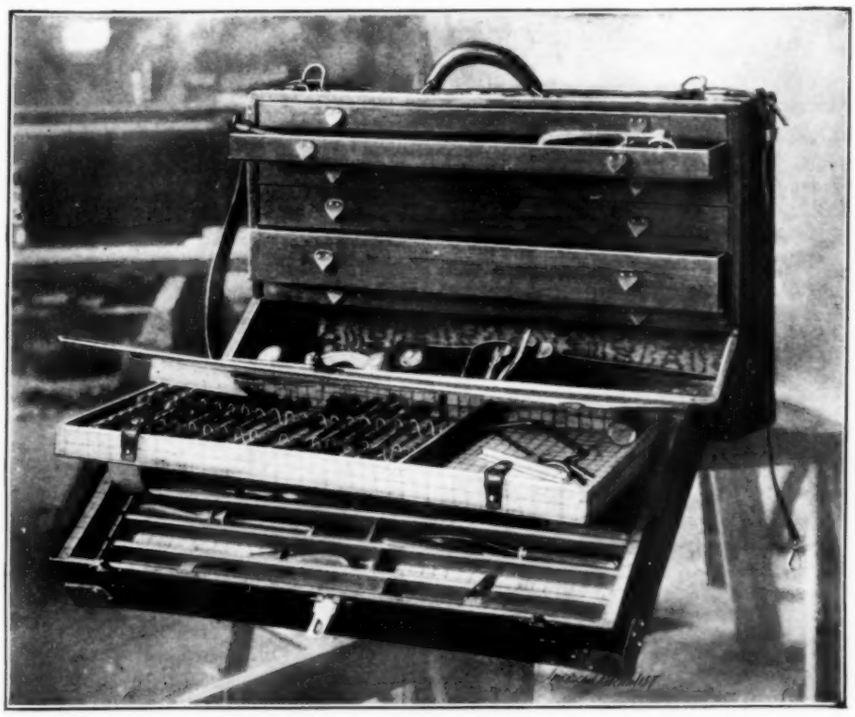


A DOUBLE TAPPING MACHINE

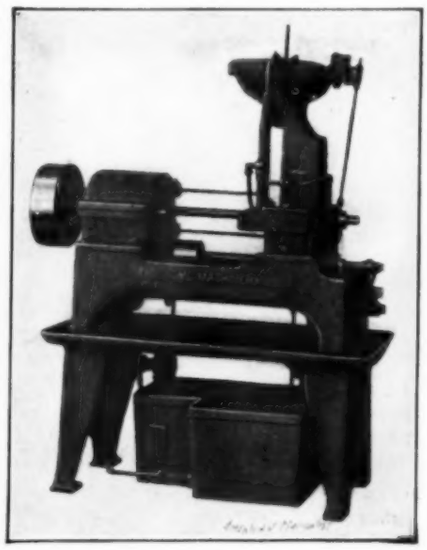
The Acme Automatic Non-Reversing Nut Tapper

This automatic tapper uses a long-shanked tap and runs the tap straight through the nut.

The nuts to be tapped are put into a hopper, which is shown at the top of the cut. The machine places these nuts automatically into a chute that leads down to the tap. There is, at the bottom of the chute, a reciprocating mechanism that keeps feeding the nuts onto the rotating tap. The tap-operating mechanism carries three taps in sockets. The tap that is opposite the feeding mechanism is the only one that is running, the other two are standing still. When the machine has filled up one of the taps with tapped nuts, the tap-carrying mechanism revolves automatically and presents another tap, whereupon the ma-



COMPACT PATTERNMAKERS' TOOL CASE



ACME AUTOMATIC TAPPER

chine proceeds to fill that with nuts, and so on.

These machines are made in three sizes, taking up to ¼ inch, ½ inch and 1 inch respectively, by the Acme Machinery Company, Cleveland, Ohio.

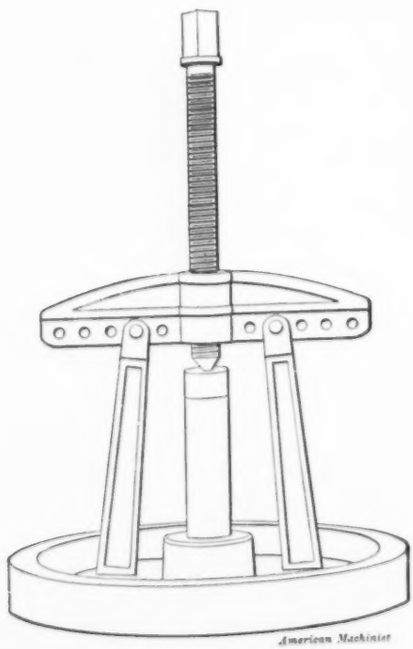
Crucible Furnace and Oil Burner—Correction

In describing the new crucible furnace and oil burner at page 942, the name of the manufacturer was given as the American Combustion Company, whereas this company had been taken over by the Anthony Company, 45 West 34th street, New York City.

In the last paragraph of the description, through an error, the word "pounds" was used instead of "ounces," in connection with the amount of air required to give practically perfect combustion.

A Wheel Puller

The line cut shows a wheel puller which is being put on the market by M. E. Kerschbaum, 103 Chambers street, New York. These pullers are made in



A WHEEL PULLER

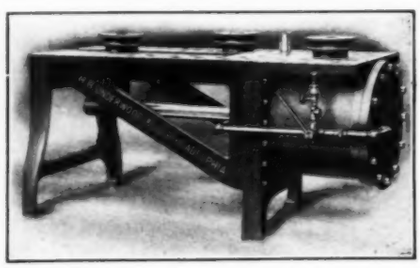
two styles, with two arms, as shown, and with three spaced 120 degrees. They are drop forged from high-carbon steel. The large size will stand a strain of ten tons and the small size, six tons.

They are supplied with a set of arms provided with hooks at the ends and also with a set of extension arms which increase the reach in the larger size from 10 to 20 inches.

A Pipe Bender

The halftone shows a new pipe bender which has been brought out by H. B. Underwood & Co., Philadelphia, Penn. Under the table is a ram which is operated by either steam or compressed air. The cylinder is 20 inches diameter and the ram has a stroke of 15 inches. The ram slides in a guide and has a stud, which projects above the table, on which rollers may be placed.

The piston has air on both sides of it at all times. The operating valve is so constructed that only the amount of air required for the actual bending is wasted. The air is transferred from one side of the piston to the other and the piston is forced forward because that side offers a



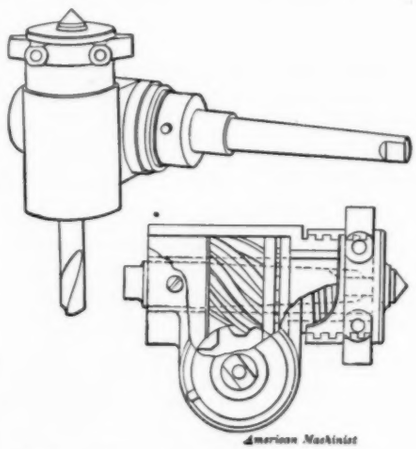
A PIPE BENDER

larger area than the other which is smaller by reason of the space occupied by the piston rod. This feature permits the piston, when necessary, being moved only a fraction of an inch, and it may be held perfectly stationary to allow for measuring or for placing a templet on the work. Such nicety of control is very desirable and is particularly useful for straightening work.

An Angle Drill for Close Corners

The illustration shows a very compact angle drill, which can be used to advantage in many places in almost any shop. It allows holes to be drilled by power in close places where a ratchet is usually considered necessary.

This consists of a casing of steel casting, bushed with a bronze bearing and driven by hardened-steel spiral, gears provided with ball-thrust bearings. The

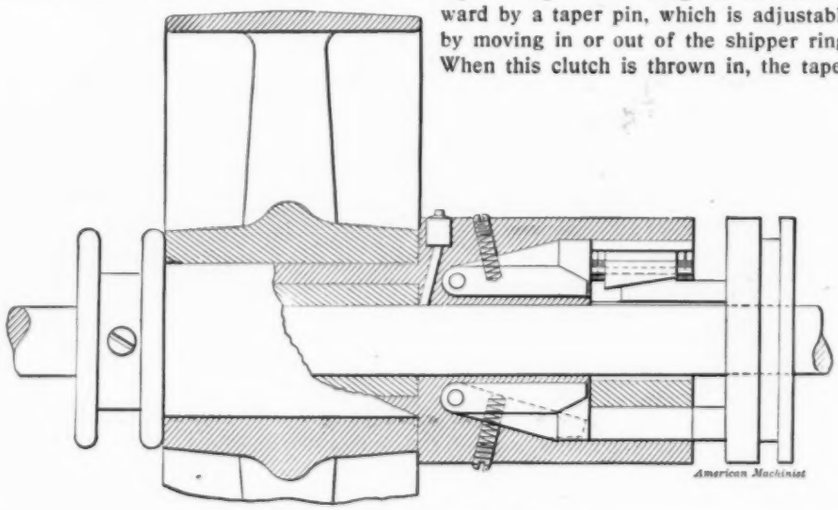


THE CLOSE-PLACE ANGLE DRILL

driving shanks are Morse taper. It is made in four sizes, holding drills from 9/16 to 2 inches in diameter, the total length of body being 2⅞ inches in the smaller and 5⅛ inches in the larger size. The weight varies from 2¼ to 10 pounds. It is made by Lowndes & Butler, Norristown, Penn.

A Positive Drive Friction Clutch

The accompanying illustration is of a new clutch which has recently been placed on the market. This clutch is novel, in that it combines the principles of both a friction and a positive clutch. From the illustration it will be seen that the friction portion is operative by the expansion of a split ring, controlled by a toggle, which in turn is operated by a taper wedge. The wedge is forced outward by a taper pin, which is adjustable by moving in or out of the shipper ring. When this clutch is thrown in, the taper



POSITIVE-DRIVE FRICTION CLUTCH

pin forces the wedge upward, expanding the ring until the necessary friction is produced for driving the pulley or line shafting as the case may be.

On the opposite diameter of the shipper ring is a stationary pin, which moves inward when the ring is forced forward to advance the taper wedge. When the friction is open, this pin will be advanced far enough to enter the chamber. The friction is now engaged and like all frictions, there is more or less slipping until the driven member is gotten up to speed. Before full speed is attained, the dogs which are held in place by the adjustment springs are thrown outward by centrifugal force across the path of the positive pin, so as to intercept the latter and positively lock the clutch, with little or no shock. It has now become a positive lock clutch and will remain so until the shipper ring is drawn backward, removing the pin and allowing the dogs to drop back into place as soon as the speed is reduced.

With this clutch it is readily seen that the maximum capacity for driving is the shearing strength of either the dog or the pin which have come in contact with each other, instead of being limited by the power of the friction surfaces. An increase in the load thrown upon the clutch cannot produce slipping and so the work of the friction surfaces is confined only to starting and getting up to speed, thus making for longer life of the clutch. The dogs and pin are of hardened nickel steel and the clutch itself is bronze bushed.

These clutches are made in all sizes and are being placed on the market by the F. C. Sanford Manufacturing Company, of Bridgeport, Conn.

The Vulcan Shear and Rod Cutter

The halftone shows a bench shear made by the Merwin Manufacturing Company, Erie, Penn. The shear blades are made of ¼-inch tool steel 4 inches long. They open 1¼ inches at the point and are adjustable and interchangeable. Cold-rolled steel up to 3/16 inch thick by 2 inches wide, can be cut with these shears. The rod-cutting attachment consists of a cylindrical steel die, set in each arm, provided with round openings which are in line when the jaws are open. With the attachment, rods or wire up to ⅜ inch diameter can be cut. An adjustable gage provides for cutting a number of pieces the same length.

A Shear and Rod Cutter

Latest Type of Curtiss Aeroplane

By Augustus Post

A machine specially constructed for a flight from Albany to New York.

Several improvements made over former designs, and floating equipment added for alighting on water.

In former issues the American Machinist has shown the developments of the Curtiss aëroplanes. These have now been carried to such a refinement that the latest machine, built for the long flight from Albany to New York City, is in all essential qualities a machine of reliability and endurance. It is shown in Figs. 1 and 2, and the changes and improvements over former machines will be pointed out briefly.

The upper main surface has been increased by the addition of two extra ribs with rubber cloth covering, making 30 inches more on each side, or an area of about 11 square feet of supporting surface, which brings the total area up to 236 square feet. The front control is larger and has been greatly refined; the uprights, formerly of wood, are now made of light tubing, to cut down the head resistance.

A steel-tube steering post has been substituted for the previous one made of wood, the steering cables passing down through its center where they are fully protected. An auxiliary oil pump actuated by the aviator's foot is provided and may be used whenever necessary to supplement the regular oiling system. The gasolene tank has been enlarged to hold a little over 10 gallons and is placed immediately back of the radiator which is also made especially large and placed just in front of the eight-cylinder, V-type,

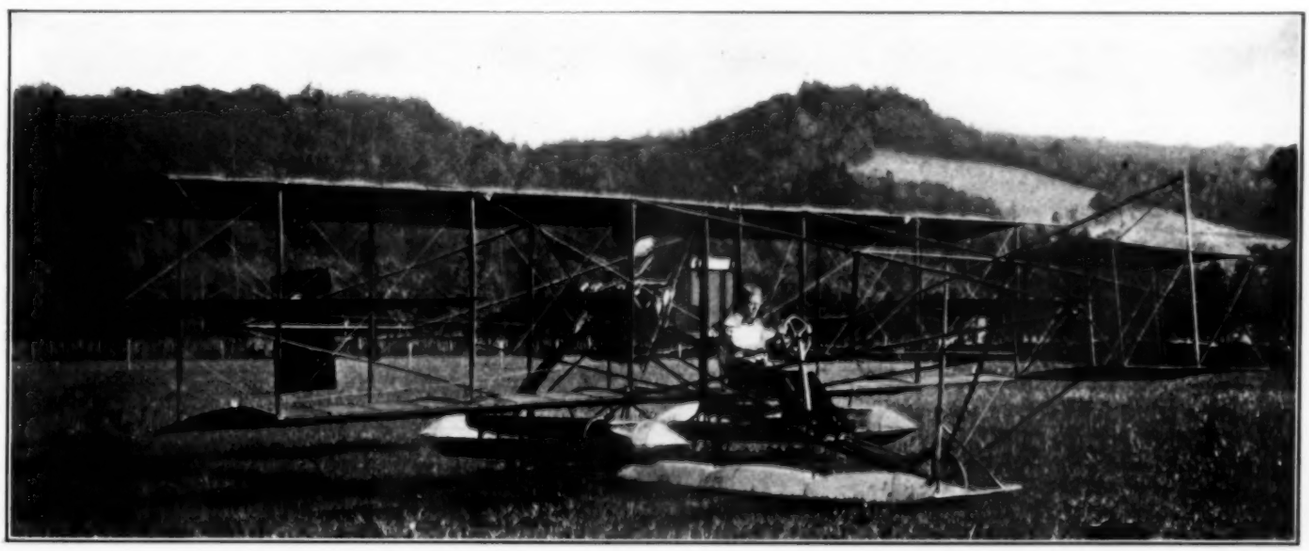


Fig. 1. Latest Type of Curtiss Aeroplane Equipped with Flotation Compartments to Alight on Water

Curtiss engine which is practically the same as the engine used in the machine with which Mr. Curtiss won the Gordon Bennett International Aviation Cup.

A Schebler carbureter is used and a Bosch magneto for ignition. The engine and propeller gives about 325 pounds thrust for an engine speed of 1080 revolutions per minute, a very good result considering that the 50-horsepower engine weighs less than 200 pounds. The weight of the whole machine loaded for the flight from Albany to New York is close to 1000 pounds, including the aviator, which gives a flying factor of over 4 pounds per square foot; this is high for a biplane.

Perhaps the most interesting special equipment for this particular flight is the addition of flotation to insure the machine from sinking, should it be necessary to land in the water.

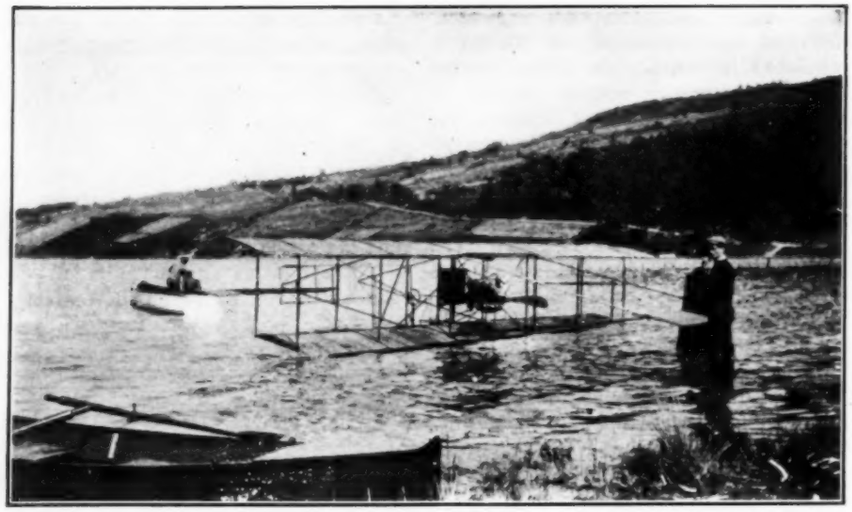


FIG. 2. CURTISS AEROPLANE FLOATING ON THE WATER

A long, flat skid about one foot wide and 12 feet long has been added, reaching from the front wheel to the axle of the rear wheels, which acts as a hydroplane in landing. This skid is slightly curved at its forward end and has attached to it a short cross piece about three feet wide, of the proper curvature to exert a lifting effect when driven through the water by the speed of landing. On the upper side of this skid, three air bags, about three feet long by eight inches in diameter, made of vulcanized silk and rubber material are placed. These are covered with canvas tacked to the sides of the board, making what looks like a long half-round canvas bag under the machine. The air bags are very light and each bag will support nearly 60 pounds; other air bags are placed under the central section of the lower main surface and at each extremity of the lower wing. These bags are held in place by thin boards fastened to the front and rear beam. Besides these air bags, cylindrical floats are placed under the lower main plane just outside of the wheel base and under the middle set of uprights on each side of the machine and are attached close to the main beams by iron braces. These bags and floats are only designed with the intention of floating the machine and to keep the engine out of the water if it should be necessary to make a landing on the river, and it was desired not to add any more to the head resistance or to the vertical surface than was absolutely necessary. When this machine was tried out on the lake at Hammondsport, the lower surface became partly submerged and the aviator's seat was just above the water line.

Feed Motion for Slotting Machine

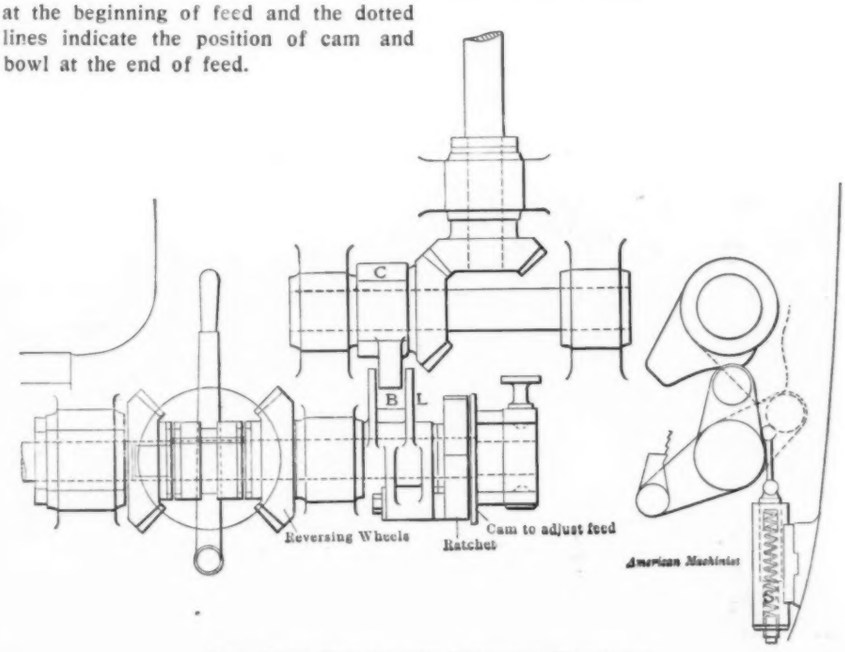
By H. Shelden

My attention was once called to the objections to high-speed slotting-machine feed motions. It was noticed that there was a great deal of wear of the cam and cam bowl. This was found to be due to the fact that so many parts connected with the feed motion had to be set in motion almost instantly at each stroke of the ram, and for only a short time. The greater part of the force on the cam was due to the inertia of the connecting rod and levers. To eliminate this I designed the arrangement shown; in which the motion of the moving parts is only rotary.

The vertical shaft derives its motion from the disk shaft and is continually rotating at the same speed as the disk shaft. On the first horizontal shaft a form of cam is fixed. This cam *C* in rotating engages with a bowl *B* and lever *L* and gives a gradually accelerating motion to the lever, which puts the feed on by means of the ratchet wheel in about 1/7 of a revolution of the driving disk.

The cam is pressed back into position by means of the spring *S*, shown in the detail view. The full lines show the cam at the beginning of feed and the dotted lines indicate the position of cam and bowl at the end of feed.

This motion was found to work satisfactorily and silently.



NEW FEED MOTION FOR SLOTTING MACHINES

Increasing Shop Capacities

Fred Blais will erect a sawmill at Remer, Minn.

Lahr Brothers, Bismarck, N. D., will erect a garage.

J. W. Porter will build a garage at Eagle Grove, Iowa.

L. D. Gray, Dickinson, N. D., will erect a broom factory.

The Wishek (N. D.) Creamery was destroyed by fire.

C. F. Eggert is erecting a cold-storage plant at Fargo, N. D.

The La Crosse (Wis.) Hat Works will enlarge its factory.

The University of Cincinnati is erecting a new power plant.

The Wahpeton (Wis.) Steam Laundry will build an addition.

S. D. Vivant will erect a blacksmith shop at Wahkon, Minn.

J. S. Bloom will erect a brick-tile plant at Independence, Iowa.

H. C. Clark & Son, Lee, Mass., will build a new machine shop.

The Providence (R. I.) Brewing Company is building an addition.

Fred Goodge's blacksmith shop at Estherville, Iowa, was burned.

The J. I. Case Company, Racine, Wis., will erect a $200,000 foundry.

The Lone Star Packing Company will erect a plant at Flatonia, Tex.

The Scott Machine Company, London, Ont., is erecting a new factory.

The Royal Linen Mills, Mystic, Conn., is building a new bleachery.

The Vors Auto Company, Mandan, N. D., will erect a $6000 garage.

Jennings' sawmill at New London, Wis., was burned. Loss, $15,000.

The glove factory of F. H. Russell, Berlin, Wis., was destroyed by fire.

A bond issue for waterworks plant is contemplated at Harlinger, Tex.

The Fergus Falls (Minn.) Woolen Mills will erect a $20,000 factory.

The Marquette University, Milwaukee, Wis., will erect a new power plant.

The Milnor (N. D.) Auto and Electrical Company will erect a garage.

Geo. J. Michelson, Rochester, N. Y., is to erect a large furniture factory.

The Dubuque (Iowa) Packing Company is erecting a new $60,000 plant.

The Great Northern Railway will erect a roundhouse at Bainville, Mont.

The Central Uphostering Company, Sheboygan, Wis., will erect a factroy.

The Cleveland (Ohio) Machine Tool Works contemplate enlarging its plant.

The Detroit (Mich.) Shear Company is building a new $15,000 factory.

The Lowney Company, Mansfield, Mass., is adding to its confectionery plant.

The Miami Vulcanizing Company, Cincinnati, Ohio, will enlarge its plant.

The Gardner & Gould Candy Company, Burlington, Iowa, will build an adition.

Yale University is planning the enlargement of its electric-lighting plant.

The Missoula (Mont.) Heating Company is planning to increase its capacity.

The Canadian Pacific Railway Company will build new shops at London, Ont.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

Scherer & Strupp, Elkton, S. D., will erect an addition to be used as foundry.

The Milwaukee (Wis.) Worsted Cloth Company will erect a $15,000 addition.

The Winter-Coleman Scale Company, Springfield, Ohio, will enlarge plant.

Garage and foundry of John Forberg, at Aneta, N. D., was destroyed by fire.

The carriage factory of Henley & Blunt, Lynchburg, Va., was destroyed by fire.

The grain elevator, owned by C. M. Linn, St. Mary, Neb., was destroyed by fire.

E. M. Hager & Sons, Buffalo, N. Y., are to build an addition to its planing mill.

Al G. Schworgler, of Madison, Wis., will build an ice-cream and candy factory.

Winston-Dear & Co., Hibbing, Minn., will erect a blacksmith and machine shop.

The plant of the Hawkeye Cabinet Company, Webster City, Iowa, was burned.

The Saginaw (Mich.) Sheet Metal Works has purchased site for a new factory.

The Gray Furniture Company, Adrian, Mich., is having a new factory erected.

The Dundas (Ont.) Knitting Mills are being enlarged to nearly double capacity.

Walter E. Hayward, manufacturing jeweler, Attleboro, Mass., is enlarging its factory.

The sawmill of W. H. Bonnell, at Hawthorne, Wis., was burned. Loss, $25,000.

The Liberty Dye Works, Reading, Penn., will install an additional boiler this fall.

The Wisconsin Engine Company, Corliss, Wis., will erect a $15,000 pattern building.

The plant of the C. S. Lee Machinery Company, Aneta, N. D., was destroyed by fire.

The Vanderwater Company will build a shuttle block factory at Nacodoches, Texas.

The construction of a municipal lighting plant is being considered at Oakland, Iowa.

The Michigan Paper Company is erecting additions to its plant at Plainwell, Mich.

The Hawkeye Button Company, of Muscatine, Iowa, will establish a plant at Oskaloosa.

The Home Steam Laundry, Big Springs, Tex., will erect a new and modern building.

Work will shortly be started on the new Pacific Mills print works at Lawrence, Mass.

The Robert Hill foundry, at Dalton, Ga., was badly damaged by fire. Loss, $20,000.

The cooper shop of Malcolm & Brown, Saginaw, Mich., was burned. Loss, about $25,000.

The H. H. Wright Lumber mill, at Merrill, Wis., was destroyed by fire. Loss, $100,000.

The Wholey Boiler Works, Providence, R. I., is building an addition to its works.

The Park Woolen Mills, Rossville, Ga., has awarded contract for an addition to its plant.

The Canton (Ohio) Sheet Steel Company has commenced the erection of a new plant.

The Canadian Westinghouse, Ltd., Hamilton, Ont., is building extensions to its plant.

The Guadalajara (Mex.) Gas Company has secured site on which to erect a new plant.

The Canadian Northern Railway intends doubling its roundhouse at Port Arthur, Ont.

The Oliver Plow Works, of South Bend, Ind., is to establish a plant in Hamilton, Ont.

The Consumers Electric Company, Wheeling, W. Va., has secured site for a new plant.

The Sykes woolen mills, at Georgetown, Ont., were destroyed by fire. Loss, $30,000.

The factory of the What-Cheer Wire Works, in Providence, R. I., was badly damaged by fire.

A. Morey & Son, printers, Greenfield, Mass., are to erect a new building and install engine.

Marion Pauley, of Kankakee, Ill., is looking for site on which to erect a cement factory.

Boiler house will be erected for A. Backers & Sons, at Fort and Tenth streets, Detroit, Mich.

J. S. Chase, De Pere, Wis., will build additions to his shingle mill at Anacortes, Wash.

The Narragansett Machine Company, Pawtucket, R. I., will erect an addition to its plant.

The Henry Vogt Machine Company, Louisville, Ky., is planning the extension of its plant.

The Cheney Bigelow Wire Company, Springfield, Mass., will build a two-story addition.

The Cincinnati (Ohio) Tool Company is considering the installation of a new gas engine.

The sawmill of the Joseph Desert Lumber Company, at Mosinee, Wis., was destroyed by fire.

Improvements to the municipal lighting plant at Mazeppa, Minn., are being considered.

The East Side Wire and Iron Works, Portland, Ore., has purchased site for a new factory.

The Wabash (Ind.) Gear Works has secured site on which a larger plant will be erected.

The Stevens Cooperage Works, Elmwood, Ont., Canada, was destroyed by fire. Loss, $10,000.

The board of health, Virginia, Minn., will purchase an incinerator at a cost of about $12,000.

The planing mill of John Cassidy & Son, Bangor, Me., was burned. Loss, about $50,000.

The woodworking plant of Hall Bros. & Wood, Philadelphia, Penn., was burned. Loss, $75,000.

A. L. Peterson, Cresco, Iowa, will erect a factory for the manufacture of electrical apparatus.

The city of Newton, Iowa, is preparing to install a new electric power plant to replace the present one.

Londel Brothers, Fort Worth, Texas, candy

manufacturers, are looking for suitable site for a new plant.

The H. S. Peters Company, overall manufacturers, Dover, N. J., will erect a factory at Welland, Ont.

The Excelsior Laundry Company, Philadelphia, Penn., has secured a permit for a one-story addition.

The plant of the Miller-Elmer Candy Company, New Orleans, La., was destroyed by fire. Loss, $50,000.

The Merchants Freezing and Cold Storage Company, Providence, R. I., is erecting an addition to its plant.

The Albia (Iowa) Light, Heat and Power Company will build an addition and install additional equipment.

The Glencoe (Minn.) Electric Light Company is considering the installation of a heat-distributing plant.

The Watson Wagon Company, Canastota, N. Y., is having plans prepared for another factory, dry kilns, etc.

The Fort Stanwix Canning Company, of Rome, N. Y., is erecting a plant at Bangor, Me., for canning corn.

Fire in the hammer shop of the Ames Shovel Works, at North Easton, Mass., caused $10,000 damage.

The Illinois Malleable Iron Company, Chicago, Ill., has purchased more ground on which to erect additions.

The Standard Implement Manufacturing Company, St. Paul, Minn., recently incorporated, will erect a factory.

The estate of Stephen Greene, printers, Philadelphia, Penn., will erect a seven-story addition to cost $100,000.

C. H. Sauer & Co., Turtle Lake, Wis., is looking for suitable site on which to erect a new woodworking plant.

The James Cunningham Company, Rochester, N. Y., is building a new factory for its automobile department.

Fire destroyed the plant of the Birmingham (Ala.) Lime and Plaster Company, causing a loss of about $10,000.

The Bullard Thread Company, Holyoke, Mass., is said to be planning to remove its plant to some other locality.

The Ohio Pressed Steel Company, Bucyrus, Ohio, recently incorporated, is looking for site on which to erect a plant.

The Big Four Clay Company, Malvern, Ohio, has increased its capital stock for the purpose of enlarging its plant.

The Hancock Stone Crusher Company, Findlay, Ohio, has increased its capital and will install additional crushers.

Fire destroyed the boiler shop and tin shop at the plant of the Port Huron (Mich.) Engine and Thresher Company.

Proposals will be received until June 6 for construction of a 150,000-gallon steel tank at Fort Logan H. Roots, Ark.

The Gisholt Machine Company, Madison, Wis., is to spend about $350,000 in improvements and additions to its plant.

The Narragansett Machine Company, of Pawtucket, R. I., will let contract soon for additions to two of its buildings.

The Western Glazed Sewer Pipe Company, Boise, Idaho, is said to be endeavoring to secure suitable site for a new factory.

Work has been started on a new plant for the Hisey-Wolf Machine Company at Colerain and Marshall avenues, Cincinnati, Ohio.

The garage of the Pennsylvania Auto Company, on Minor avenue, North Seattle, Wash., was destroyed by fire. Loss, $20,000.

The Galveston-Houston Electric Railway Company, Houston, Texas, has acquired site on Clear Creek, for a new power plant.

The Schwahn-Seyberth Wholesale Saddlery Company, Eau Claire, Wis., is planning the erection of a large manufacturing plant.

The Philadelphia (Penn.) Rapid Transit will shortly begin the erection of a power house at Germantown and Erie avenues.

The National Biscuit Company, Kansas City, Mo., has bought site on which a new six- or seven-story factory will be built.

The Seeger Refrigerator Company, St. Paul, Minn., is planning the erection of a $45,000 factory in the Midway district.

A. Dorfner will erect a three-story dye house in the rear of 1324 West Girard avenue, Philadelphia, Penn., to cost $10,000.

The B. C. K. Motor Company, Hay and Franklin streets, York, Penn., will shortly break ground for an additional building.

The McClary Manufacturing Company, London, Ont., manufacturing stoves and tinware, is building an addition to its plant.

Captain Edward Berry, Rensselaer, N. Y., dredge owner, is building a machine shop on his lot opposite the Forbes avenue station.

The main building of the Pilgrim Foundry Company, in Dorchester, Mass., was destroyed by fire. The company manufactures stoves.

Wm. Lanning, of Aberdeen, Wash., is considering the erection of a factory for the manufacture of a patent change machine.

The Montreal (Ont.) Steel Works, Ltd., has purchased site on which a new plant, to cost about $2,000,000, will be erected.

Frank Jirous, of Clarkson, Neb., has purchased the Creighton Roller Mills, at Creighton, Neb., and will put in new machinery.

The R. K. Le Blond Machine Tool Company will shortly receive bids for two additions to its plant at Linwood, Cincinnati, Ohio.

The plant of the Santa Clara Lumber Company, at Faust, near Tupper Lake, Utica, N. Y., was destroyed by fire. Loss, $150,000.

The Southwestern New York Traction Company, with headquarters at Bolivar, N. Y., will erect a power station at Allentown, N. Y.

The plant of A. Kilpatrick & Sons, St. Louis, Mo., manufacturers of iron kettles, was burned. Loss, $25,000. Will be rebuilt.

The Harty Press Company, New Haven, Conn., has awarded contract for the erection of a new $30,000 factory and office building.

The Consumers Ice and Cold Storage Company, Sacramento, Cal., has announced that it will erect a six-story cold-storage building.

The Tri-State Automobile Company, Minneapolis, Minn., is erecting a repair shop in the rear of garage at 111-113 Central avenue.

The Dowden Manufacturing Company Prairie City, Iowa, manufacturing potato-harvesting machinery, will build an addition.

Francis R. Weller, Washington, D. C., was awarded contract for the construction of a hydroelectric power plant for Bedford City, Va.

The Acme Box and Shook Company, Kenton, Ohio, has changed its name to the Acme Automobile Company and will make motor cars.

The plant of the Linderman Box and Veneer Company, at Eau Claire, Wis., recently burned, will probably be rebuilt on a larger scale.

Chas. A. Zilker, San Antonio, Tex., and associates, will shortly award contract for the construction of a $200,000 cold-storage plant.

The Hardy Manufacturing Company, Hastings, Mich., is looking for a suitable site on which to erect a large machine-manufacturing plant.

The Crown Novelty Company, Providence, R. I., manufacturing celluloid goods, is moving into a larger factory and will increase its output.

The Vulcan Steam and Forging Company of America is considering plans for the erection of a large addition to its plant in Buffalo, N. Y.

The city council of Pe Ell, Wash., granted a franchise to L. A. Webb, of Aberdeen, Wash., for the installation of an electric-light plant.

The Grand Rapids and Indiana Railroad has taken out building permits in Grand Rapids, Mich., for one-story wheelhouse and roundhouse.

The John A. Roeblings Sons Company, Trenton, N. J., manufacturing wire rope, tramways, etc., will build several additions to its plant.

The Cadillac Motor Car Company is to make extensive improvements at its plant in Detroit, Mich., during the summer, including new foundry.

The Southern Railway has awarded contract for the erection of an $85,000 boiler house at Spencer, N. C. Main office is Washington, D. C.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to June 14 for bolts, pipe, saws, valves, etc., as per Circular No. 586-a.

A large modern laundry will be built at the New Jersey State Hospital for the insane, at Trenton, N. J. Engine and two boilers will be installed.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 17, for vanadium-steel chain as per Circular No. 584.

The special committee from the board of trade, at Cleburne, Texas, closed a deal with parties for the erection of a $40,000 foundry and machine shop.

The Standard Metal Company, 500-84 Van Buren street, Chicago, Ill., is making investigations toward finding suitable site for a large new foundry.

The Pacific Board and Paper Company, Seattle, Wash., has purchased site and will erect a plant for making paper and cardboard from waste paper.

The Pullman Car Company is converting former testing rom at its plant in York, Penn., into a machine shop and will employ 100 more machinists.

It is stated that Hassett & Dodge, carriage manufacturers, Amesbury, Mass., are considering the securing of larger quarters. Might go to another locality.

The Crown Manufacturing Company is preparing to rebuild plant at Phelps, N. Y., which burned some time ago. The company's product is seed drills.

A hydroelectric plant will be built at Spring Valley, Minn., this summer, under the supervision of Chas. D. Stanton, electrical engineer, Omaha, Neb.

The Standard Wire Cloth Company has purchased ground at Valley Forge, Spring Garden township, York, Penn., on which a factory will be erected.

The Great Northern Railroad has awarded contract for the construction of a foundry at the Dale Street shops, St. Paul, Minn. This is to cost $85,000.

The Dart Manufacturing Company, Anderson, Ind., manufatcuring commercial motor vehicles, will move to Waterloo, Iowa, where a new plant will be erected.

Francis P. O'Reilly, of Philadelphia, has purchased the Prizer-Painter stove plant at Millmont, near Reading, Penn., and will operate same on a larger scale.

Franklin B. Ware, State architect, has made some preliminary plans for the new power house at Albany, N. Y., to be built at North Hawk and Orange streets.

The Cincinnati, Hamilton & Dayton Railroad will soon award contract for the construction of new shops and roundhouse at Toledo, Ohio, to cost $100,000.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 23, for steel castings, repair parts for shovels, as per Circular No. 586.

Contract has been awarded for the construction of a garage and repair shop on East Fifty-ninth street, near Euclid avenue, Cleveland, Ohio, for J. E. Crabbe.

Sealed tenders will be received until noon, June 6, for the construction of sewage-disposal works for the city of Regina, Sask., Canada. A. H. Chivers, city clerk.

Plans have been prepared for a laboratory for shop practice to be erected on Castle Point, Hoboken, N. J., by the Stevens Institute of Technology, to cost $75,000.

Edward Double, president of the Union Tool Company, of Los Angeles, Cal., has purchased of Charles E. Bolles, a large foundry at West Chicago, Ill., and will enlarge same.

Work is to be commenced at once on the Campbell-Kingsley factory, at Wyandotte, Mich., for the manufacture of automobile parts. Plant will employ 300 men.

The Highland Manufacturing Company, Holyoke, Mass., manufacturing envelops, pads, etc., is looking for a site on which to erect a larger and uptodate plant.

James Craig, Jr., manufacturer of gas engines, 556 West Thirty-fourth street, New York, will erect a factory on Garfield avenue, Jersey City, N. J., at a cost of $25,000.

The Henderson-Sturges Piano Company, a $150,000 corporation, has selected site in Anniston, Ala., for a plant. J. C. Henderson, of Anniston, is president and treasurer.

Plans for a new plant for the Atlantic Broom Company, at Toone and Second streets, Baltimore, Md., have been completed and call for two large buildings to cost about $50,000.

It is understood the Alabama Consolidated Coal and Iron Company will take some action relative to building a steel plant at Gadsden, Ala., within the next three months.

The Taplin-Rice-Clerkin Company, Akron, Ohio, is planning to improve its plant located on Broadway. New machinery will be installed in power house and plant will be almost entirely replaced by new buildings.

The Beaver Dam (Wis.) Foundry Company has purchased site for a plant. Will erect one building this summer for the production of grey iron, brass and aluminum castings.

A. V. Schleumbach and F. O. Andrews, of Altoona, Penn., are looking for site in the Middle Atlantic section on which to erect a plant for the manufacture of boxes and crates.

A. C. Grant, of New York, and H. K. Parkman, Springfield, Vt., are said to be interested in the establishment of a new electric automobile factory in the New England section.

The plant of the C. G. Conn Company, Elkhart, Ind., said to have been the largest makers of brass-band instruments in the world, was destroyed by fire. Loss, about $500,000.

The Baldwin Forging Company, now located at the Ohio Penitentiary, has established headquarters at Charleston, W. Va., and will erect a plant there to cost about $100,000.

The plants of the Cincinnati Roofing, Tile and Terra Cotta Company, and the Jacob Freund Roofing Company, Cincinnati, Ohio, recently burned, will be rebuilt at once on a larger scale.

The Capital Gas Engine Works, Wrightsville, Penn., is having plans prepared for a new plant to be erected on site still to be secured. Will probably be in the Middle Atlantic section.

A new hoist capable of sinking to depth of 2000 feet are the instructions from President Graves, of Boston, to General Manager Imer Pratt, of the Eagle and Blue Bell mine, at Eureka, Utah.

The Rundle-Spence Manufacturing Company, Milwaukee, Wis., making steam filters and plumbers' supplies, has purchased ground on which a new factory will be erected in the near future.

The Mosher Water Tube Boiler Company, Hudson Terminal, New York, is making arrangements to erect a new plant in New Jersey to take the place of the present one at Ossining, N. Y.

The plant of the Jackson, Church, Wilcox Company, at Saginaw, Mich., owned by the General Motors Company, is to be enlarged and working force doubled. About $150,000 will be expended.

The Bristol Company, Waterbury, Conn., manufacturing recording instruments and steel belt lacing, will erect an additional building to be used for increasing the output of steel belt lacing.

The Cole & Hatch Machine Company, of Somerville, Mass., has leased a building at Portsmouth, N. H., for the manufacture of marine engines and engine supplies. Will also do repair work.

Negotiations are in progress by the Bellaire (Ohio) Enameling Company to take over the plant of the Spellacy-Raiff Company, of Coshocton, for the purpose of increasing its output.

Announcement has been made by the Union Pacific Railroad that call for bids will soon be issued for the construction of new car shop and planing mill at Omaha, Neb., to cost about $400,000.

The Northern Pacific Railroad has announced that the northwest Minneapolis terminals are to be enlarged and shops and roundhouse built, involving an initial expenditure of $500,000.

The Mead Engine Company, Dayton, Ohio, recently incorporated, will shortly decide on site for a plant to manufacture auto engine devised by Cyrus E. Mead. Several hundred men will be employed.

The Pennsylvania Railroad is planning to erect a new station at Newark, N. J., to cost about $1,000,000. Power equipment, freight and elevator lifts and freight-handling equipment will be installed.

A two-story building is being erected on Saginaw street, Pontiac, Mich., which will be occupied by Steel & Clark, of Toledo, Ohio, who will manufacture delivery and truck wagons and do repair work.

The Northern Turpentine Company, Marinetto, Wis., recently organized, will erect a plant outside the city and is platting a town for a population of 4000 people. Turpentine will be manufactured from pine stumps.

Plans have been completed and bids asked for by Ballinger & Perrot, Philadelphia, Penn., for power house and laundry building and refectory and kitchen building for the Immaculate Heart Academy, at Frazer, Penn.

The Baush Machine Tool Company, Springfield, Mass., is doubling the capacity of its pattern shop and also extending foundry and cleaning room. The company will make a specialty of multiple- and radial-drilling machines.

The W. F. Robertson Steel and Iron Company, Cincinnati, Ohio, has taken over the plant of the Union Sheet and Tin Plate Company, at Marietta and will make a specialty of tinplates. Three of the mills will be started soon.

Wm. F. Brain, 87 Green street, Jersey City, N. J., and Henry A. Smith, 165 Remsen street, Brooklyn, N. Y., are interested in a new electric-weighing machine invented by Mr. Braun, and are looking for suitable place to manufacture same.

The Otis Elevator Comapny, which recently acquired the plant of the Marine Engine and Machine Company, at Harrison, N. J., is to erect two buildings, one to cost $40,000, to be used as machine shop, the other to cost $30,000 to be used as a molding shop.

The Pennsylvania Steel Company is arranging to make extensive improvements at the plant of the Maryland Steel Company, at Sparrows Point, which it controls, including two new rolling mills. Improvements will also be made at the plant in Steelton, Penn.

Sealed proposals will be received at the office of the constructing quartermaster, Fort Leavenworth, Kan., until 11 a.m., June 7, for installing six new boilers and overhauling central heating plant. Information can be had of Capt. Wm. D. Davis, quartermaster.

The Blittendorf Street Car and Axle Company, of Davenport, Iowa, and the Canadian Car Wheel and Foundry Company, of Montreal, are planning to combine plants and are endeavoring to secure site, preferably in the Middle Atlantic section on which to erect a plant.

Sealed proposals will be received at the office of the constructing quartermaster, 263 Summer street, Boston, Mass., until 10 a.m., June 6, for the construction of an electric-lighting system at Fort Andrews, Mass. Information can be had of Capt. A. M. Miller, quartermaster.

The Sowers Manufacturing Company, Buffalo, N. Y., recently formed to take over the business of the H. W. Dopp Company, is building an addition to its plant for which equipment will be needed. The company will manufacture engines, pumps, heaters, gray-iron castings, steam-melting and mixing kettles, special machinery.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 9, for steel, iron, bronze, copper, steel and copper tubing, pipe and fittings, exhaust valves, rivets, bolts, nuts, reamers, files, jacks, diaphragm pumps, tube expanders, machinists' clamps, lubricators, gage glasses, steam whistles, leather fillet, leather belting, etc., as per Circular No. 585.

Contracts have been awarded Worden & Allen Company, Milwaukee, Wis., for the erection of a plant to be operated by a new company for the manufacture of steel tubing. The plant, with machinery, is to cost $300,000, and employ between 600 and 800 men. F. W. Renshaw, of Chicago, is president of the comapny and Geo. J. Thust, formerly with the Detroit Steel Company, superintendent.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 14—Pneumatic tools (schedule 2522), 300 tons foundry coke (schedule 2521); June 21—3510 pounds wrought-iron or steel nuts, 1500 pounds composition spikes, 23,500 pounds galvanized-iron spikes, 7510 pounds iron washers (schedule 2545), 50,000 pounds manganese bronze (schedule 2546), 78,400 pounds sheet copper (schedule 2545), steel, etc. (schedule 2545).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: June 7—Four coal cars (schedule 2525), band saw, jig saw (schedule 2526), name plates (schedule 2533), steel rivets (schedule 2535), 6000 gallons engine oil (schedule 2537), 323,000 gallons lubricating oil (schedule 2542), 11,775 pounds brass rod (schedule 2534), 142,000 pounds wrought iron, 4500 pounds steel angles, 48,000 pounds forged steel, 49,400 pounds plate

steel, 12,300 pounds galvanized sheet steel (schedule 2535), 9000 feet wrought-iron or steel pipe, brass tubing, steel tubing (schedule 2541), 6700 pounds brass tubing (schedule 2534), 60 tons foundry coke, 300,000 gallons fuel oil, 10,000 gallons fuel oil (schedule 2539).

BUSINESS ITEMS

As an indication of rapidly improving business conditions, the Triumph Electric Company, Cincinnati, Ohio, reports large sales of power equipment during the past three weeks.

The Ready Tool Company, manufacturer of the Red-E tools and toolholders, owing to the rapid increase in its business, has been compelled to move from New Haven to a larger plant, corner of Oak and George streets, Bridgeport, Conn., where its increased facilities will enable it to fill orders promptly.

NEW INCORPORATIONS

Northwest Ice Machine Company, Seattle, Wash. Capital, $20,000. Incorporators, Leon Hebert, W. M. Olin.

Jaeger Hardware Company, Elmore, Ohio. Capital, $15,000. Incorporators, H. A. Jaeger, C. J. Miller, J. H. Jaeger.

Coulter-Paxton Company, Hammond, Ind. Manufacture steel tools. Capital, $30,000. Incorporators, W. G. Paxton, C. J. Coulter.

Horner Piano Company, Chicago, Ill. Manufacture pianos and organs. Capital, $20,000. Incorporators, S. Horner, S. H. Horner, L. K. Horner.

Canton Motor Car Company, Canton, Ohio. Operate garage, etc. Capital, $50,000. Incorporators, J. E. Milner, P. E. Mooch, A. E. Mitzel, etc.

Wolff-Trautz Company, Newark, N. J. Refine gold, silver, etc. Capital, $50,000. Incorporators, John B. Wolff, C. C. Trautz, Sr., A. L. Trautz.

Wilcox Motor Car Company, Chicago, Ill. Motors and motor vehicles. Capital, $12,000. Incorporators, Arthur L. Ballas, F. J. Wegg, Geo. J. Meier.

Standard Cleaner Company, Chicago, Ill. Manufacture cleaning devices. Capital, $50,000. Incorporators, L. C. Bonney, D. A. Roberts, F. Posvic.

Camden & Trenton Traction Company, Trenton, N. J. Operate railroads, etc. Capital, $675,000. Incorporators, F. Evans, E. A. Martin, C. R. Rens.

Economy Switch Box Company, Cleveland, Ohio. Manufacture electrical switch boxes. Capital $15,000. Incorporators, A. Tucker, A. D. Levy, C. L. Levy, etc.

Lawson Manufacturing Company, Chicago, Ill. Manufacture hardware specialties. Capital, $25,000. Incorporators, W. J. Gold, O. Katzeberger, E. W. Pottle.

Cincinnati Chair Company, Cincinnati, O. Manufacture furniture of all kinds. Capital, $?0,000. Incorporators, Robert Heufurt, Jr., Edward Heufurt, N. R. Park.

Twombly Motors Company, New York. Manufacture motor vehicles. Capital, $1,000,000. Incorporators, D. Stuart Dodge; H. T. McGarvie, W. Irving Twombly.

New Brunswick Piano Company, New Brunswick, N. J. Manufacture pianos, etc. Capital, $20,000. Incorporators, S. J. Cox, S. S. Newton, A. C. McDonnell.

Celina Specialty Company, Celina, Ohio. Manufacture steel specialties. Capital, $30,000. Incorporators, Walter Mersman, Edw. Brandts, Ed. H. Mersman, etc.

Pyle Spring Tire Company, Indianapolis, Ind. Manufacture automobile tires and parts. Capital, $50,000. Incorporators, D. C. Pyle, W. G. Hunter, W. D. Pyle.

Chambers Manufacturing Company, Shelbyville, Ind. Manufacture stoves and heaters. Capital, $20,000. Incorporators, E. A. and J. E. Chambers, G. H. Meek.

Georgetown Ice Manufacturing Company, Camden, N. J. Manufacture ice, cold storage, etc. Capital, $40,000. Incorporators, W. F. Eidell, J. A. MacPeak, I. C. Clow.

O'Brien Stone Company, Bellefontaine, Ohio. Quarrying and stone-crushing business. Capital, $40,000. Incorporators, W. P. O'Brien, S. A. Haskins, Frank Dowell, etc.

Cooper Machinery Company, St. Louis, Mo. Manufacture and deal in machinery. Capital, $12,000. Incorporators, Wm. H. Cooper, W. O. Williamson, L. O. Goodrich.

American Gas Company, Chicago, Ill. Manufacture gas machines, fixtures, etc. Capital, $200,000. Incorporators, Frank M. Campbell, Wm. H. Carlin, H. A. Nichols.

Ohio Motor Sales Company, Toledo, Ohio. Operate garage, repair shop, etc. Capital, $10,000. Incorporators, Frank W. Coughin, E. H. Winkworth, F. C. Miller, etc.

Falcon Motor Car Manufacturing Company, Camden, N. J. Manufacture automobiles, etc. Capital, $125,000. Incorporators, Frank A. Kuntz, Jos. P. Murray, Wm. S. Kell.

Hudson Sales Company, Weehawken, N. J. Manufacture adding machines, cash registers, etc. Capital, $100,000. Incorporators, I. Graham, K. H. Isaacs, M. R. Walpole.

Lawrence M. Stein Company, Chicago, Ill. Manufacture and deal in machinery and supplies. Capital, $12,000. Incorporators, C. B. Stafford, T. C. Kennedy, W. R. Leeper.

Allen Manufacturing Company, Hartford, Conn. Manufacture machinery. Capital, $50,000. Incorporators, Wm. G. Allen, Ira Dimock, Stanley K. Dimock, J. T. Noyes.

Simmons Washing Machine Company, Cattaraugus, N. Y. Manufacture washing machines. Capital, $50,000. Incorporators, J. C. Simmons, G. Claude Carey, Jos. A. Setter.

Perfect Cigarette Packer Company, New York. Manufacture and deal in cigarette-packing machines. Capital, $100,000. Incorporators, W. L. Ball, H. L. Coffin, G. S. Ludlow.

Dyett Tool and Engineering Company, Ilion, N. Y. Manufacture tools, engines, boilers, machinery, etc. Capital, $100,000. Incorporators, F. J. Dyett, B. B. Ross, A. L. Johnson.

Lexington Veneer Company, Lexington, Ohio. Manufacture veneers, baskets, boxes, etc. Capital, $30,000. Incorporators, R. Thompson, H. F. Thompson, Howard S. Twitchell, etc.

Dulles-Baldwin Electric Drill Company, Kerhonkson, N. Y. Manufacture and deal in drilling machinery, etc. Capital, $600,000. Incorporators, J. H. Baldwin, F. P. Darte, E. T. Magoffin.

Perfect Briquette Binder Company, Jersey City, N. J. Manufacture briquettes from coal, culm, peat, etc. Capital, $100,000. Incorporators, H. O. Coughlan, L. H. Gunther, John R. Turner.

Deyo-Macey Engine Company, Binghamton, N. Y. Manufacture and deal in gas and gasolene engines, motors, etc. Capital, $100,000. Incorporators, R. Herbert Deyo, Frank T. Macey, J. T. Deyo.

Cahill Music Machinery Company, Jersey City, N. J. Manufacture electric music-generating and distributing machinery. Capital, $500,000. Incorporators, E. Hilton, Jackson, George F. Cahill, A. T. Cahill.

Zackey Talking Machine Company, Dover, Del. Manufacture dictating and talking machines. Capital, $50,000. Incorporators, H. W. Leslie, C. P. Tasker, Philadelphia; F. B. McCarthy, Claymont, Del.

Ketch-on Door Stop Company, Camden, N. J. Manufacture and deal in door fasteners. Capital, $100,000. Incorporators, R. P. Davis, S. G. Brosius, Philadelphia, Penn.; W. Roberts, Riverton, N. J.

United Clothing Machine Company, Cleveland, Ohio. Manufacture machines for making clothing and general factory equipment. Capital, $10,000. Incorporators, Geo. A. Murray, B. S. Smith, B. L. Shaw, etc.

Greene & Nicholls Manufacturing Company, Chicago, Ill. Manufacture and deal in laundry machinery and laundry supplies. Capital, $50,000. Incorporators, Jos. A. Greene, H. J. Nicholls, J. P. Fitzgerald.

Jewell Steel and Malleable Company, Buffalo, N. Y. Manufacture and deal in articles of steel, iron, copper, etc. Capital, $50,000. Incorporators, W. E. Jewell, North Tonawanda; A. W. Valentine, B. Knox, Buffalo.

Elizabeth & Trenton Railroad, Jersey City, N. J. Capital, $1,200,000. Incorporators, I. Shupp, Jr., C. L. Rihl, Philadelphia; C. Sinnickson, Rosemont, Penn.; H. H. Aikens, J. W. Kelley, A. E. Garwood, Llanerch, Penn., etc.

Brightwood Motor Manufacturing Company, New York. Manufacture and deal in automobiles and accessories. Capital, $10,000. Incorporators, H. B. Layman, 68 West Ninety-sixth street; W. A. Reereamer, 55 Wall street, etc.

Guttenberg Pearl Button Company, Brooklyn, N. Y. Manufacture and deal in buttons, etc. Capital, $10,000. Incorporators, Max Brody, 166 Manhattan avenue; Harry Nagin, 193 Graham avenue; Jos. Horowitz, 115 Stagg street.

Aetna Heating and Ventilating Company, New York. Manufacture and deal in plumbing, ventilating, stem- and gas-fitting supplies. Capital, $50,000. Incorporators, E. Glantzberg, A. Nelson, New York; C. Klander, Chelsea, Mass.

TRADE CATALOGS

The Heald Machine Company, Worcester, Mass. Catalog describing internal, cylinder, ring and drill grinders. Illustrated, 96 pages, 6x9 inches, paper.

Morse Twist Drill and Machine Company, New Bedford, Mass. Catalog of twist drills, reamers, chucks, milling cutters, taps, dies, machinists' tools. Illustrated, 364 pages, 5x7 inches, paper.

Charles H. Besly & Co., 118-124 North Clinton street, Chicago, Ill. Catalog describing Besly spiral disk grinders, band-polishing machines, spiral circles, etc. Illustrated, 78 pages, 6x9 inches, paper.

FORTHCOMING MEETINGS

American Society of Mechanical Engineers, spring meetings, Atlantic City, N. J., May 31-June 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANT ADVERTISEMENTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Machinery to order, or will purchase good patents. Interstate Machinery Co., Troy, N. Y.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Machine shop to manufacture and market new labor saving machine without any competition, for royalty and some cash. Box 575, AMERICAN MACHINIST.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Wanted—To manufacture small machines, or parts; punch press, screw machine, lathe, shaper and multiple drill spindle work quoted on at reasonable prices. Joseph Pollak, 215 Sydney St., Dorchester, Mass.

We are about to complete a large contract and are, therefore, in a position to take up the manufacture of fine instruments, parts for the same, dies and jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

We have for sale some machine shop capacity and are in position to make contracts for building small machines or parts thereof, in quantities only, and would be glad to do this work on a percentage of cost basis; correspondence solicited. Quride Co., Syracuse, N. Y.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Petersboro, Ont.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

ILLINOIS

Wanted—A machine designer with experience in building woodworking machinery. Box 574, AMERICAN MACHINIST.

Wanted—An experienced man for general foreman of a shop manufacturing woodworking machinery. Box 573, AMER. MACHINIST.

Wanted—First-class mechanic, thoroughly familiar with automobile engine construction, as assistant on assembling floor. Apply Excelsior Motor Mfg. Co., 22d & Halsted Sts., Chicago.

Wanted—First-class mechanic, thoroughly familiar with automobile engine construction, as inspector on assembling floor. Apply Excelsior Motor Mfg. Co., 22d & Halsted Sts., Chicago.

Wanted—Gas engine expert to take charge of final test, inspection and checking out department of a large gas engine factory; none but competent men need apply. Box 572, AMERICAN MACHINIST.

A splendid opportunity is offered a responsible party who has well equipped machine shop and capital to manufacture exclusively during the time of the patents a perfected device that will increase the capacity of a large number of machine tools now in use from 25 to 50 per cent.; the basic principle of this device is entirely new, and its field is a very large one; reference required. Box 565, AMERICAN MACHINIST.

Wanted—Tool steel salesman; a live, first-class salesman for Chicago, must be a Chicago man, to sell Allen's tool steels; reliable, resourceful and energetic man with good practical knowledge of and experienced in handling high grade steels; none but practical men need apply; replies will be treated in strictest confidence, but must cover fully previous and present employment, experience in detail, age, references, salary expected, and complete record; opportunities limited only by employe's ability. Apply by letter only to Mr. J. C. Ward, Director, Edgar Allen & Co., Ltd., 434 West Randolph St., Chicago.

INDIANA

Wanted—Machinists, we are continually increasing our force; we invite application from lathe and floor hands, those who desire a steady position. Apply at Wood Turret Machine Co., Brazil, Ind.

Wanted—Toolmakers, automatic screw machine operators, bevel gear operators for Bilgram and Gleason machines; also a man with capacity as foreman for automatic and hand screw machine department, first-class man for case-hardening department, one experienced in handling gears for automobile work; give age, experience and references. 423 Johnson Block, Muncie, Indiana.

MASSACHUSETTS

Wanted—Mechanical draftsman experienced on machine tools, jigs, etc., to work in drafting department of large machine shop; steady employment for right party. Fore River Shipbuilding Co., Quincy, Mass.

MICHIGAN

Wanted—A manager with a few thousand dollars to take charge of a manufacturing plant, located in central Michigan. Box 563, AMERICAN MACHINIST.

Wanted—Immediately, first-class metal patternmakers, tool and jig makers; give reference and experience; steady work. Holm's Machine Mfg. Co., Sparta, Mich.

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Drop forge superintendent who can show a successful record for at least five years can obtain position with large company in Michigan, who will pay good salary to the man who can produce results; the man must be able to design dies, plan equipment, direct die and forge room foreman and build up first-class organization. In reply give references, age and salary expected. Box 540, AMERICAN MACHINIST.

MISSOURI

Wanted—Chief draftsman with technical engineering training, with machine shop and foundry experience, able to produce economical results. Curtis & Co. Mfg. Co., St. Louis.

Wanted—Chief inspector; one familiar with steel bolsters and car work by large steel plant in West; one with car building experience preferred; give references and experience. Box 576, AMERICAN MACHINIST.

NEW JERSEY

Wanted—First-class water meter general foreman accustomed to precision work; state terms and previous experience. Box 543, AMERICAN MACHINIST.

Wanted—Mechanical draftsman; man with experience on cranes and structural work, by concern near New York; state salary wanted. Box 534, AMERICAN MACHINIST.

Wanted—First-class water meter engineer having had experience in designing and manufacturing; state requirements, age and previous experience. Box 542, AMER. MACH.

Wanted—Working foreman wood pattern maker, one who can figure on work and has executive ability; to the right man good wages and steady work will be given; give age, experience, etc. Box 564, AMER. MACH.

Tool room foreman familiar with molds for plastic materials; must be experienced in designing, estimating, cost keeping and handling men; permanent situation for competent man; near New York. Box 566, AM. MACH.

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands and die makers; call in persons if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia).

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia.)

NEW YORK

Wanted—Planer hands, floor repair hand, lathe hands. Address P. O. Box 761, North Tonawanda, N. Y.

Wanted—First-class machinist to run Acme automatic screw machines; state experience in full and give references. Box 491, AM. M.

Wanted—Draftsman, competent to make general machinery layouts and details; must do own tracing. Box J, Niagara Falls, N. Y.

Wanted—An expert factory cost accountant; one who has an established record only will be given consideration. Address E. L., P. O. Box 1688, New York City.

Wanted—Tool or die makers accustomed to very close and accurate work; first-class men only; good wages; steady position. Doehler Die Casting Co., Court & Ninth Streets, Brooklyn, N. Y.

All-around machinists, including lathe, drill, planer, milling machine and vise hands, can obtain steady employment by applying to Brooks Works of the American Locomotive Company, Dunkirk, N. Y.

First-class machinists and tool makers wanted; applicants must state wages desired and give previous experience in order to receive further consideration. Address Ingersoll-Rand Co., Painted Post, N. Y.

Wanted—A young man, ambitious toolmaker; American; accustomed to small, accurate work; excellent chance for advancement. Write, giving full information about yourself to Box 557, AMERICAN MACHINIST.

Wanted—Competent lathe, milling machine and vise hands; good wages and permanent employment for first-class mechanics who are temperate and industrious; references required. "Machine Tools," AMER. MACHINIST.

Wanted—Thirty machine shops in Rochester, N. Y., wants first-class machinists for steady positions; to efficient men wages $16.50 to $21 per week and 9 hours per day; open shop. Write P. O. Box 252, Rochester, N. Y.

Wanted—Toolmakers on model and experimental special automatic machine work; good pay and steady work to competent men; give age, experience and references. Apply The S. S. White Dental Mfg. Co., Princes Bay, N. Y.

Superintendent wanted for Eastern printing press factory; must have ability to handle men without friction, increase production, and reduce cost. Apply stating fully, nationality, age, experience, references and salary expected. Box 590, AMERICAN MACHINIST.

Wanted—General foreman with thorough knowledge of manufacturing methods; must have wide experience in punch press, screw machine, milling machine work, etc., and be capable of handling men and work without friction; references required; state salary expected. Box 537, AMERICAN MACHINIST.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

OHIO

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Draftsmen familiar with detail crane design; state wages desired. The Toledo Massillon Bridge Co., Toledo, Ohio.

Wanted—Foreman for die tool room; must be expert on dies for general line of sheet metal work. The Toledo Machine & Tool Co., Toledo, Ohio.

Wanted—Salesman to sell emery wheels in Ohio, Pennsylvania and New York; give age, experience, references and salary expected. Address "W. E. S.," AMER. MACH.

Wanted—A concern manufacturing farm machinery wants an assistant machine shop foreman, one who is thoroughly uptodate and can produce results. Box 570, AMER. MACH.

Wanted—Five first-class diemakers; those used to blanking and forming; permanent employment and good pay. Address J. C. Lester, Supt., The Davis Sewing Machine Co., Dayton, Ohio.

Expert salesman wanted by the Defiance Machine Works, of Defiance, Ohio; must be thoroughly familiar with the general woodworking trade in the United States; one conversant with wheel and wagon manufacturing preferred; applicants should be under middle age and able to give first-class references; a good position for a high-class man. Box 571, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

Mechanical engineer with technical education, familiar with power plant, machinery and tools, transmission equipment, etc., for a large sheet-metal working plant in Middle West employing 1000 men; should have knowledge of tools and dies for blanking, forming and drawing sheet steel, brass and tinplate; force includes 60 diemakers, and equipment includes a large number of stamping and drawing presses, automatic screw machines, machine tools, electrical equipment, etc. Address, stating fully qualifications, experience and salary expected. Box 567. AM. M.

PENNSYLVANIA

Wanted—Draftsman, experienced in automobile work; give age, nationality, experience and salary expected. Box 544, AM. MA.

Draftsman—Bright, ambitious young man, one capable of doing detail work on motors, transmissions, axles, and other automobile work; one accustomed to detailing and making finished shop drawings required; bright future. Please communicate by letter or call in person. Mack Bros. Motor Car Company, Allentown, Pa.

Wanted—We have positions to offer from time to time for the following lists of first-class mechanics: Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Any all-around machinist, who is willing to work at his present rate of wages while learning drop forge, die sinking and trimming die making under competent instruction, will find it to his advantage to communicate with U. M. & D. F. Co., 408 Lapham Bldg., Providence, R. I.

WISCONSIN

Wanted—Operator capable of setting up and running Cleveland automatic screw machine. Address Superintendent Gas Engine Department, Fuller & Johnson Mfg. Co., Madison, Wis.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Machinist, age 25, married, night foreman in general repair shop, desires day position with possibilities for advancement. Box 561, AMERICAN MACHINIST.

ILLINOIS

First-class mechanical engineer, at present employed as master mechanic assistant, desires change; experienced also as draftsman; executive ability; references. Box 589, AM. M.

Mechanic, 38 years old, 20 years' experience as tool and die maker, held position as foreman the last 2 years, wishes position with reliable firm; either tool room or manufacturing department. Box 587, AM. MACH.

Designer with 8 years' experience in machine tools, automatic and special machinery, conveyer, transmission, rolling mill machinery; college graduate with machine shop practice; can arrange interview if near Chicago. Box 588, AMERICAN MACHINIST.

MASSACHUSETTS

Mechanic, age 35, six years' experience as foreman, superintendent and designer, good executive, 5 years in present position, desires change. Box 582, AMERICAN MACHINIST.

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 519, AMER. MACH.

MICHIGAN

German designer of modern gas engines, age 28, graduate by German polytechnic, wants position. W. Fromm, Owosso, Mich.

Mechanical structural man, eight years' experience in estimating, designing, construction and general engineerng work, wishes proposition. Box 562, AMERICAN MACHINIST.

MINNESOTA

Chief draftsman, experienced, seeks position. Address Box 558, AMER. MACHINIST.

NEW JERSEY

Position to superintend the design and construction of special or automatic machinery and tools; 17 years' practical experience; best reference. Box 569, AMER. MACHINIST.

Are you looking for a first-class machinist of wide experience on cost reduction, one who cuts the time by designing special tools and jigs; if so, address Box 580, AM. MACH.

NEW YORK

General foreman (34); executive, practical, natural ability, reliable; New York City surroundings; interview. Box 586, AM. MACH.

Hardener and temperer and case-hardener seeks position; 20 years' experience. Address "Hardener." Box 584, AMERICAN MACHINIST.

Gas engine designer desires change; wide experience in design and construction of heavy duty engines; age 29; technical graduate. Box 552, AMERICAN MACHINIST.

Mechanical engineer, wide general experience, marine engines, valves, steam turbines and mill work, shop and office, technical graduate, desires change. Box 583, AM. MA.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 578, AMERICAN MACHINIST.

Foreman machinist with executive ability, wishes position; large experience in handling help; experienced on engines and machinery of all kinds; excellent references. Address "S. T.," 5124 9th Ave., Brooklyn.

Designer, graduate, 12 years' experience, adding machinery, typewriters, fixtures, automatic machinery, experimental design, inventive and practical, open for engagement. Address Box 577, AMERICAN MACHINIST.

Mechanical engineer (27), thoroughly experienced, besides four years' practice as draftsman, two years as assistant master mechanic, desires similar responsible position with smaller or medium size manufacturing concern or consulting engineer; references. Box 560, AMERICAN MACHINIT.

By mechanical draftsman with 7 years' experience in machine design, light automatic machinery as well as rolling mills, hoisting, conveying, hydraulic machinery, automobile work and special machine tools; technical education, shop practice; location immaterial; interview if in or near New York. Box 559, AMERICAN MACHINIST.

Position desired as superintendent or designer of special machinery, labor-saving devices, fixtures, tools, etc., with reliable firm; first-class uptodate practical man; technical education; good draftsman, executive ability, resourceful, inventive; 10 years' supervising experience; age 31; salary $3000. Box 585, AMERICAN MACHINIST.

OHIO

Machine designer and draftsman (32), of 10 years', practical experience on automatic and special machinery, tools, etc., desires position; will work for moderate salary where there is a future for a live, energetic, capable man; location immaterial. Box 579, AM. MA.

Experienced superintendent, now employed, is open for change; expert on light and medium machinery, automobile work and sheet metal stamping; drafting room experience, and all-around factory man; American, strictly sober, honest and industrious; location, northern Ohio. Box 568, AM. MACH.

WISCONSIN

Foreman open for engagement; successful in increasing production and reducing costs of manufacturing; executive ability; expert jig designer, will go anywhere; references. Box 495, AMERICAN MACHINIST.

Position wanted as a superintendent or general shop foreman in a large machinery manufacturing plant; I am 35 years of age, strictly sober and understand modern shop methods; have had lots of experience in handling men for over 14 years; understand designing Corliss engines, air compressors, ice machinery and tool and die work; will be ready to take position June 1; can give very best of references. Box 496, AM. MA.

FOR SALE

For Sale—Working interest in modern machine shop. Address "W," Box 467, AM. MA.

For Sale—Interest or control in manufacturing business; exceptional opportunity for manager or instrument maker. Box 516, AMERICAN MACHINIST.

For Sale—42" Bullard boring mill in good condition, having been in service only three years; send us your bill for the above. Detroit Stoker Company, Detroit, Mich.

For Sale—A complete Davis-Bournonville oxy-acetylene apparatus in first-class order; has been used about one year; can be seen at the Hartford Suspension Co., 150 Bay St., Jersey City, N. J.

For sale or lease, best equipped foundry in Kansas City; switch facilities; plenty of room; fine opening for right party. Address O. E. Durham, Care Commerce Trust Company, Kansas City, Mo.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.

Model Foundry for Casting Iron—I

By E. F. Lake

A foundry which uses machinery wherever possible to effect a saving in labor.

Raw material is brought in and finished product taken out in an unbroken stream which insures rapidity and economy.

Continuous pouring, shaking out molds, cutting over and elevating sand, makes it possible to use the same sand several times a day.

For foundries that are designed to produce small castings similar to those used for pipe fittings, the blue ribbon doubtless goes to the new foundry of the General Fire Extinguisher Company in Providence, R. I. The designing of the building and the details of its construction and equipment are the result of the efforts of Henry A. Carpenter, foundries manager of the company, assisted by Mr. Arnold, the foundry superintendent.

The product of the foundry is the ells, tees, crosses, reducers, etc., that are used in erecting the company's automatic sprinkling apparatus. These are made of cast iron, and the molds are put up, the castings shaken from them, to disappear down chutes, in such a systematic way, and in such a continuous stream, that one familiar with the older foundry methods thinks he is in a magician's house.

Many thousands of castings are made every day and an idea of the amount of metal used can be obtained by a glance at the stock-yard and foundry buildings in Fig. 1. In the foreground are seen the piles of different grades of pig iron and in the background to the right is shown the coke. This picture was taken from the platform of a car, that was on the railroad track that runs alongside of the yard. About three-fourths of the total length of the main foundry building is shown.

The four-story wing to the right contains two cupolas, with space left for a third, as well as elevators and apparatus for handling the raw materials, and the ladle-drying oven. From the door, covered with a storm shed, down through the yard runs a track and the materials are loaded onto a car and run into the elevator.

The lower or ground floor of the main foundry building is used for cutting over and mixing the molding and core sands and for separating the castings from the gates, sprues, and other scrap material and loading them into bucket cars for transferring to the cleaning room. This is an improvement over a similar foundry built by the Worthington Steam Pump Company, at Harrison, N. J., who placed this part of the foundry in the cellar so the molders would be on the ground floor and hence all of this material had to be hoisted out.

Above this is the molding floor and here the molds are dumped onto grates so the sand will go through to the ground floor, while the castings are sent down chutes which will be described later. That the molding floor is light and cool, even though a continuous pouring of metal is going on, is shown by the numerous windows and ventilators on the side of the building.

No castings are cleaned in this building as it was considered best to do this in a separate building and thus not inter-

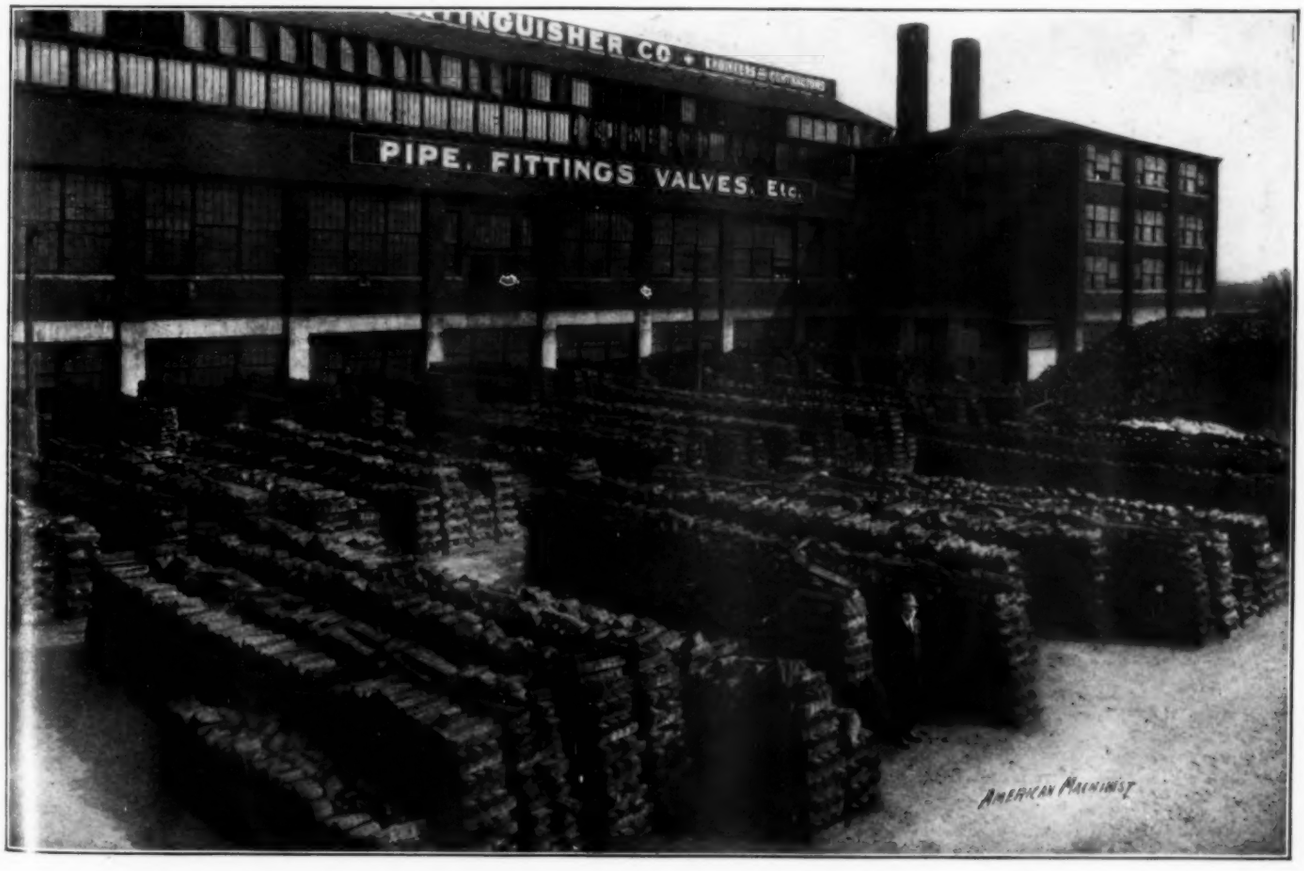


FIG. 1. THE NEW FOUNDRY OF GENERAL FIRE EXTINGUISHER COMPANY CONTAINING MANY NOVEL FEATURES

rupt the molders and core makers with the noise, dust, etc., that are always caused by cleaning castings. The castings are loaded into buckets that travel on an overhead track across an alley into another building.

Machine-molding Floor

The main foundry floor is shown in Fig. 2. Here all of the molds are made on molding machines. This floor of the foundry has a partition about 7 feet high, running down the entire length of the foundry, except at each end where an opening of about 8 feet is left. On the other side of this partition are located the core rooms, ovens and a small department for doing the necessary hand molding.

Fig. 3. Group of Castings Showing Different Kinds Made

Fig. 2. The Molding-machine Floor of the Foundry

To the extreme left of the halftone is shown a corner of the cupola, and above the gangway is shown the I-beam track on which the ladles of iron are conveyed to the different molder floors for pouring. In front of the cupolas and alongside the gangway are shown iron pig molds in which the excess metal is poured. These show white in the picture.

On the right-hand side of this view are shown wooden boxes in which the cut over molding sand is conveyed up above the floor and can be dropped into the molds as the molder needs it. Between these and the molds are shown the grates on which the molds are shaken out. In the center of the grate, or rather, between two grates, is the top of the chute into which the castings are thrown.

In this foundry even though hundreds of thousands of castings are turned out every day one does not see acres of

Fig. 4. Some of the Larger Patterns with Hinged Core Boxes for Green-sand Cores

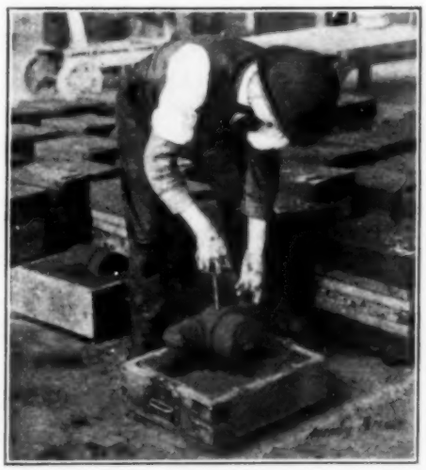


FIG. 5. SETTING GREEN-SAND CORES

molds set up on the floor waiting to be poured, as after a start is made in the morning, the pouring is kept up continuously all day, and Fig. 2 is a typical view of the foundry with several molders' floors ready to be poured. This photograph was taken during the noon recess, when the cupolas were plugged. The cupolas are again tapped as soon as work starts, and the molds poured, shaken out, and the castings sent to the floor below, as fast as the molds are rammed up.

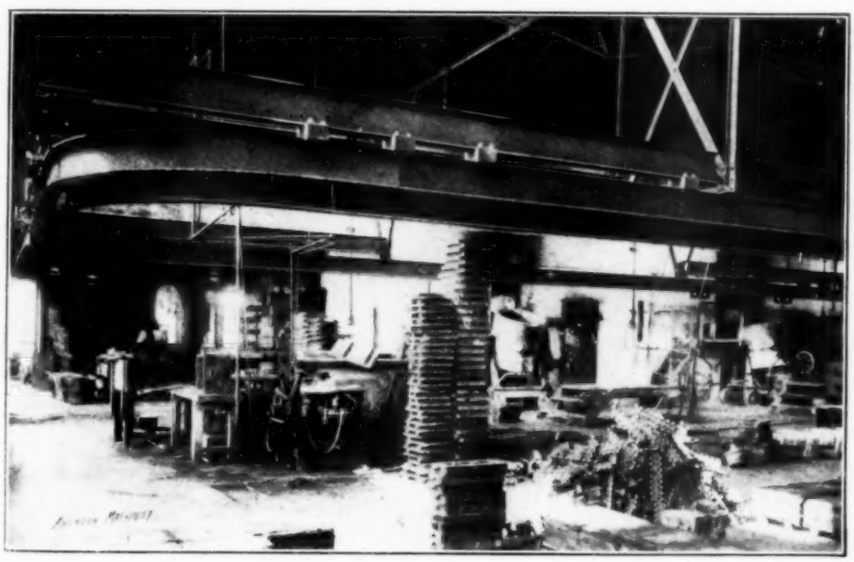


FIG. 6. IN FRONT OF CUPOLAS READY TO TAP THE IRON

This round of operations continues until quitting time at night.

CASTINGS AND PATTERNS

An idea of the kind of work that is being molded here is shown in the group of castings in Fig. 3. These are ordered in lots of several thousand at a time, some of the smaller ones being ordered in hundred thousand lots. Most of the larger castings are made with green-sand cores. A first-class grade of iron is required for these castings as they must be soft enough to machine, tough enough to withstand hard usage and a water pressure, and be fine grained, with no blow holes or porous spots that might cause leakage.

In Fig. 4 is shown one side of the foundry pattern room. In these racks will be seen some of the larger patterns that are molded, while on the floor in front of the racks are shown the iron boxes in which are made the green-sand cores. As will be seen, the two halves of the core box are hinged together so that when the core is rammed up, it is only necessary to swing the upper half of the box out of the way and lift the core out.

No shelves are required in this rack, as the molding-machine plate, on which the pattern is fastened, slides into the rack on cleats and forms its own shelf. On many of the patterns different kinds of flanges are required and these are shown on top of the rack. When a different flange is needed, all that is required is to remove three screws, take the old flange off and put the other in its place and insert the screws.

FIG. 7. OVEN AND TRUCK USED IN DRYING THE LADLES

A plate with a tapped hole is located in the center of the green-sand cores so they can be easily handled without breaking. A rod with a handle is screwed into this in order to lift the cores and set them in the mold. In Fig. 5 a molder is shown in the act of lowering one of these green-sand cores into its core prints.

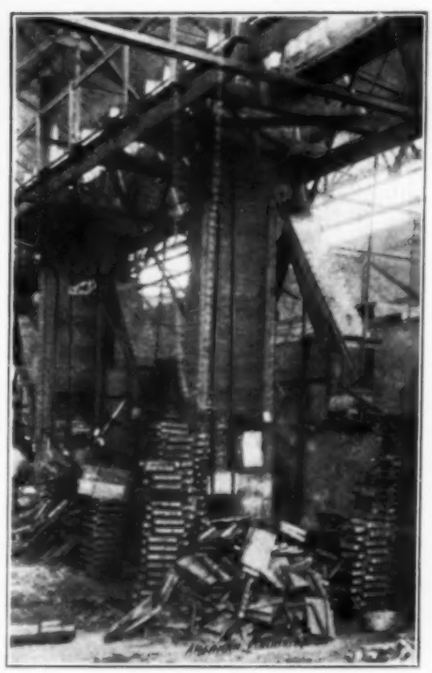


FIG. 8. SAND CONVEYERS

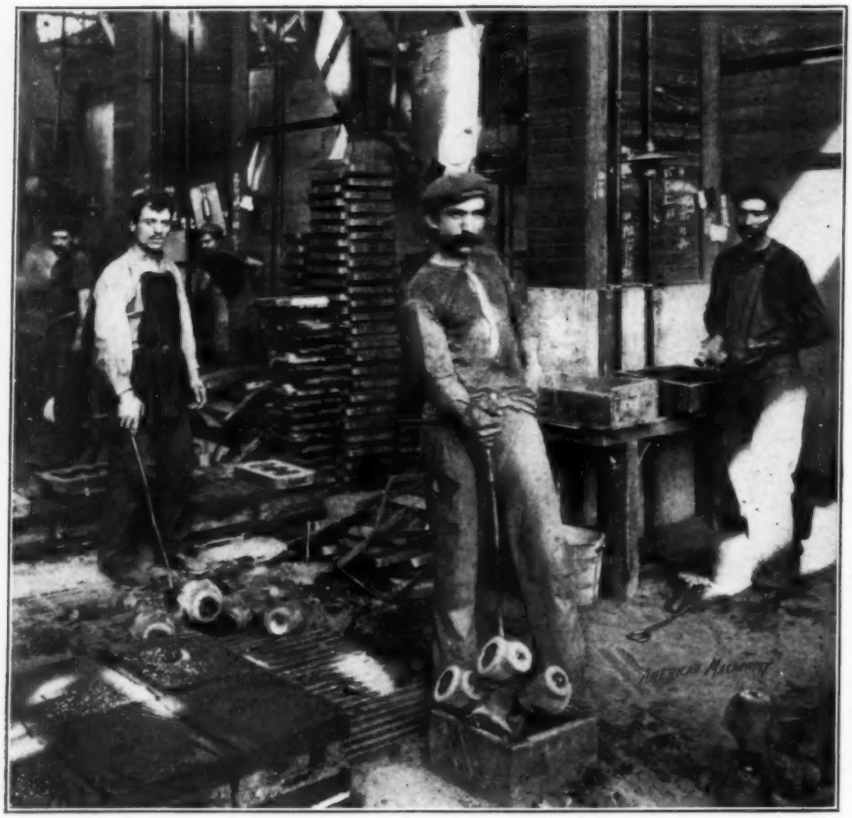


FIG. 9. DUMPING MOLDS AND SHAKING OUT CASTINGS

OVERHEAD RAILROAD

In Fig. 6 is shown the front of the cupolas as they are ready to tap the iron into the ladles. The iron is then turned from these large ladles into smaller ones, similar to the one shown in front of the big ladle to the right. These are conveyed by means of the overhead track to the molders' floor, where the metal is run into the pouring ladles. By this means a perfectly homogeneous mixture is obtained and a good iron in the casting.

Safety switches are used in the overhead track shown, so that it is impossible to run a ladle of hot iron off of the track and thus cause bad burns or more serious accidents. At different points down through the foundry crossovers are inserted between the two tracks so that the empty ladles can be brought back without going to the extreme end of the foundry. This also enables one ladle to be moved past another.

An idea of the switches used can be obtained from the view of the overhead track to the extreme left of Fig. 6. Here the far end of the track goes to the back of the wing in which the cupolas are located, to pick up the freshly dried ladles from the oven that is beside it. The piece of track in the foreground of the top of the picture goes across the building into the hand-molders' floor, for conveying the hot metals to them.

LADLE OVEN AND SAND CONVEYERS

In Fig. 7 is shown the ladle-drying oven, and the car on which the ladles are loaded and run into the oven. This car, as will be seen, is made of angle irons and has three floors. On the car are the hand ladles for pouring, while on a floor to the left of the car are seen the ladles that hang from the track, to convey the metal down the foundry.

In Fig. 8 is shown the sand-conveying system. The sand is carried up through the wooden box from the floor below, where it is cut over and prepared for molding. The elevator in the wooden box supplies two molders with sand, as it is in the form of a Y, one branch pass-

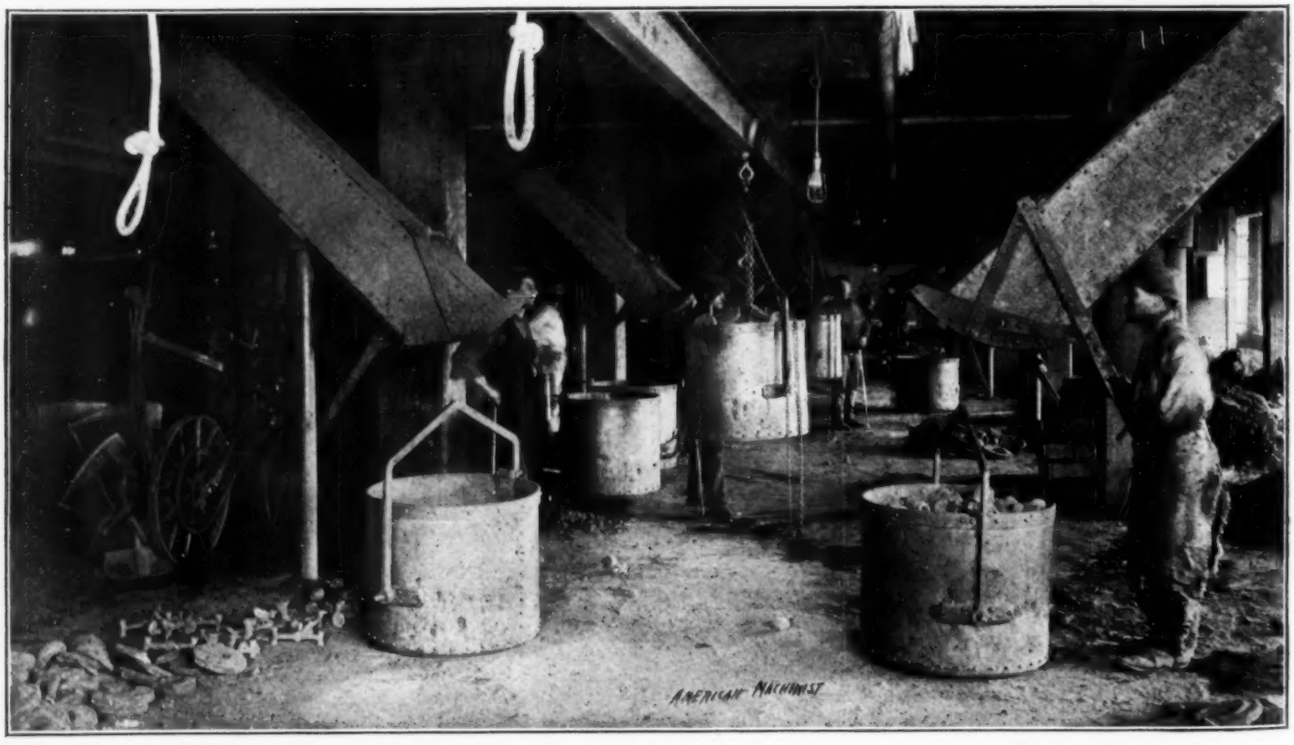


FIG. 10. LOWER FLOOR WHERE SAND IS CUT AND CASTINGS LOADED FOR REMOVAL TO CLEANING ROOM

ing to each side of the elevator. As soon as the molder places the flask on the molding machine he pulls the lever at the end of the chute. This lever opens the end of the chute and allows enough sand for making the mold to drop in the flask directly underneath.

Shaking Out Molds

When the molds are poured, they are dumped on the grates shown in Fig. 9, as soon as the castings solidify. This allows the sand to drop through to the lower floor to be recut. The castings with their gates and sprues, are then picked off the grate with an iron hook, and dropped into the top of an iron chute, that takes them to the lower floor, as shown in the center of the picture. The mold bands and bottom boards are piled back by the machine for the machine operators' use. To the right a helper is seen setting the cores and the hieroglyphics on the box show the way he keeps track of the number of molds put up.

From these views it can be seen that the hot sand and hot castings are removed from the foundry as soon as the molds are cast. Thus, most of the heat, fog, gases, etc., that make it so disagreeable in many foundries when pouring off, are removed. Together with the good ventilation, this makes the foundry a comfortable place to work in, even though they are pouring castings the larger part of the day.

Ground Floor

A view of the floor below the molders is shown in Fig. 10. In the upper part of the picture to the extreme left is shown the chute through which the sand comes that has been dumped into the grate above. Below it is shown the machine that recuts the sand to make it ready for the molder's use. The iron chutes shown projecting from either side, at an angle of about 45 degrees, are the ones in which the molders put the castings, as shown in Fig. 9. The man to the right has hold of the lever with which he opens the end of the chute and drops the castings on the floor when he is ready to load them.

Tensile Tests of Cast Iron

The way in which a practical founder met contract specifications in the application of cast iron and the interesting results secured.

The L. H. Goodnow Foundry Company, of Fitchburg, Mass., has just completed a contract for furnishing 30,000 solid shot castings for the United States War Department.

These solid shot when finished are 20 inches long, 3¼ inches in diameter, and weigh 20 pounds. A finished specimen is shown in the middle part of the accompanying halftone illustration. They are used for target practice.

The Government specifications are very rigid. The finished shot must be sound and free from cracks, sand flaws, honeycombs, or small holes indicating spongy metal or a want of soundness. From each heat or cast two test pieces must be prepared, taken from castings selected at random by the inspector. These test pieces are tested for tensile strength, and this strength must not be lower than a certain fixed standard. In this contract of the Goodnow Foundry Company the low limit for tensile strength was fixed originally at 25,000 pounds and was later raised to 27,000 pounds.

Turning again to the halftone, at the left is seen a shot casting, from which the test piece has been cut. Below is the hollow mill used for cutting these test pieces, and above at the right is a finished test specimen. The diameter at the neck is 1.129 inches, or a section having an area of exactly one square inch. The thread on the end is 1½x12. In passing it is interesting to note that each shot is cast point downward and with a very large sprue containing about five pounds of metal.

The Olsen testing machine at the foundry was carefully calibrated with the large testing machine at the Watertown Arsenal. Thus the reliability of the testing machine and its calibration were established. The machine was fitted with special holders having a ball-and-socket device to distribute the stress.

In completing this contract 37 casts were made, and from each cast two test pieces were prepared and broken in the testing machine, under the supervision of a Government inspector. The load in pounds required to break each specimen is given in the accompanying table, in which each pair of test pieces comprising an odd and its following even numbered piece were from the same cast.

Shot and Test Piece

The castings were machined all over, both on the body and base, and the iron showed a very fine grade of a medium steel-gray color, readily machined.

The table of tests deserves considerable study. The first striking feature is the amount of load required to break the specimens. These loads will average about twice the load required for ordinary cast iron. The second feature is the uniformity of the loads. While there are some below the average and others above, yet the average is well maintained and the tests show a praiseworthy uniformity. The low tests are numbers 16, 17, 53 and 56, giving respectively 27,000, 26,200, 26,000 and 27,000 pounds per square inch tensile strength. These are about on the lower limit as set by the specifications. The high tests are num-

No.	Load in Pounds.	No.	Load in Pounds.
1	38,000	38	36,500
2	30,000	39	33,500
3	34,600	40	29,000
4	32,100	41	39,000
5	31,700	42	33,000
6	31,500	43	33,000
7	35,000	44	31,500
8	35,100	45	32,500
9	35,500	46	33,500
10	38,000	47	31,500
11	33,000	48	27,000
12	33,500	49	34,600
13	30,800	50	34,800
14	31,700	51	35,000
15	33,500	52	34,800
16	27,000	53	26,000
17	26,200	54	35,000
18	34,500	55	35,000
19	33,500	56	27,000
20	29,000	57	35,300
21	38,000	58	31,000
22	35,000	59	35,000
23	30,000	60	35,700
24	28,000	61	28,000
25	37,500	62	32,700
26	30,000	63	30,500
27	33,000	64	34,400
28	35,000	65	34,500
29	31,000	66	34,000
30	29,000	67	36,000
31	32,000	68	36,200
32	27,000	69	34,500
33	28,000	70	31,400
34	32,000	71	35,000
35	29,000	72	30,000
36	35,000	73	28,000
37	35,000	74	31,500

Record of Tensile Tests.

German File Testing Machine

By Dr. Alfred Gradenwitz

A machine which enables a user of files to test their quality and to quickly determine the most desirable grades for different kinds of work.

In spite of the revolution produced in the manufacture of files by the adoption of file-cutting machines, the partisans of the old manufacturing method are still numerous, and even the mechanical process so closely imitates the primitive method that this branch of tool manufacture can be considered as the most conservative.

According to the opinion held by most engineers it would be impossible to warrant even an approximate uniformity in the quality of files, even those belonging to the same lot showing the most striking departures in regard to their hardness. This unsatisfactory state of affairs can be remedied by the use of a file-testing machine, a type of which has been recently designed by Messrs. De Fries & Company. This machine enables any file consumer to make sure that only suitable files are being used in his works. The tests made by the constructors, moreover, yield instructive information as to the behavior and possibilities of this indispensable tool.

The fact that testing by hand fails to give any reliable results as to the quality of the file will be readily understood when it is considered that there can be no uniformity in the pressure exerted. This uniformity is insured by the testing machine of which a short description is given in the following:

Description of the Machine

The file to be tested is fixed on a table (see Fig. 2) having a reciprocating motion between two slide rests, which are adjustable to files up to 470 millimeters (19 inches) in length, while being provided with a device for adjusting the files absolutely parallel to its direction of motion. In the case of especially heavy files a second chuck is provided.

The files are tested on a rod one square inch in cross section, the number of inches filed off this rod as well as the number of strokes performed by the file and the time taken by this operation are read from a diagram. The file stroke, in the case of the usual tools, is 155 millimeters (6.2 inches) in length, but can be shortened in the case of smaller files. As experience has shown the performance on the same side to be uniform throughout the length of the file, it is obviously quite necessary to test the whole length of the tool.

The testing rod, located on idlers, is thrown against the file by a uniform weight and attached by a chain. In order to avoid any increase in the effective weight of the chain, its free end is left hanging below the weight on the ground. During the backward course of the file the testing rod is withdrawn from it.

The diagram is traced on a tape of ruled paper wound around a drum, the same as in a steam-engine indicator. The style is fixed on a rod moving in the direction of its length, which is so connected by a band chain with the testing rod as to cause the style to move in a direction parallel to the axis of the drum through the same amount as filed off the testing rod, and accordingly to record this amount. The paper drum is rotated by a clock work with each stroke of the file, so that each full rotation corresponds to 120,000 strokes. The displacement of the style and the rotation of the paper drum thus yield a curve from which an accurate determination is obtained of the work performed by the file in each unit of time. A spherical weight on one file holder is applied against the back of the file, in order to prevent any vibration.

Messrs. De Fries & Company have made comprehensive tests with this machine on files cut from given materials,

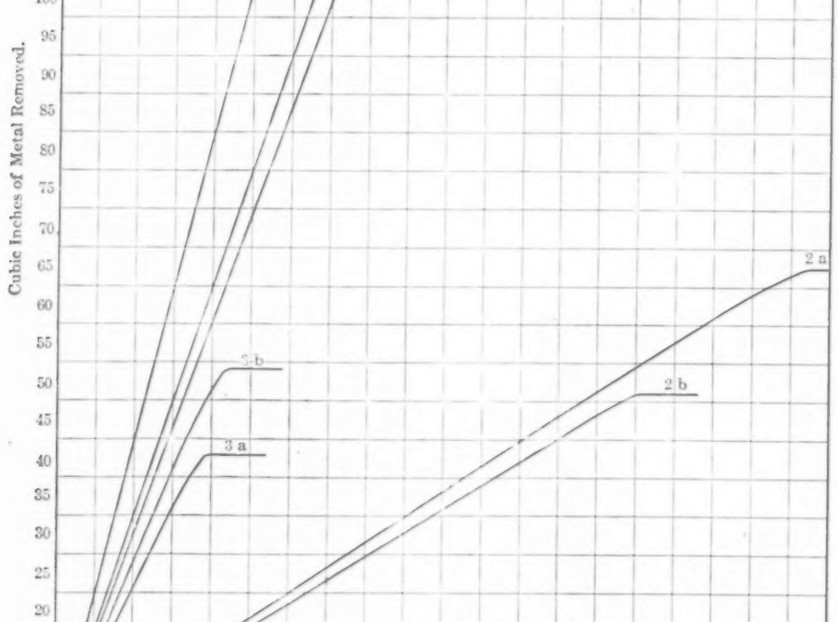


FIG. 1. CHARACTERISTIC CURVES OF FILES

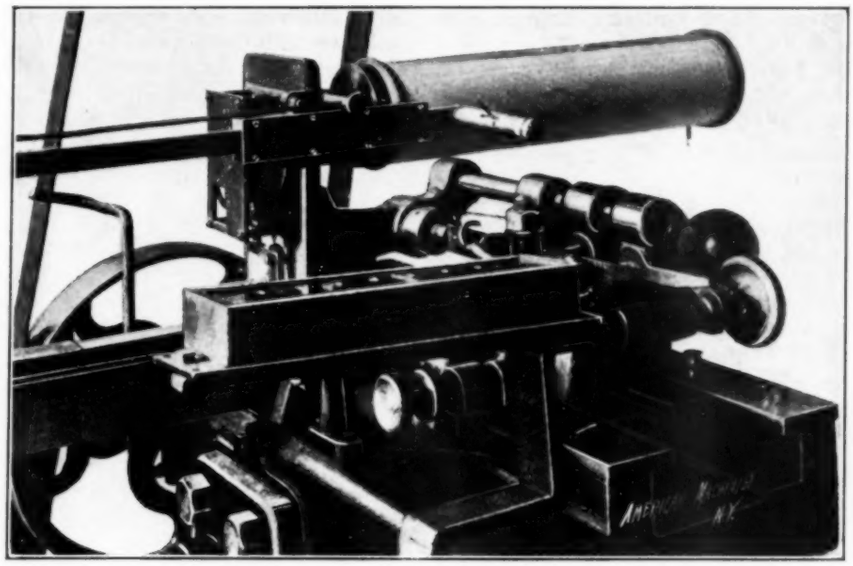


FIG. 2. A GERMAN FILE-TESTING MACHINE

for example, cast iron, wrought iron, steel, etc., using test rods of the same material. One of the special files having been fixed in position in the testing machine, the cast-iron rod was filed with 5000 strokes, after which this rod was replaced by a wrought-iron rod, while the file itself was left in the machine, and the same process continued until 5000 strokes had been filed by the rod on each of the testing rods. The curve then showed the cutting possibilities for each metal. Similar tests were made on each of the files.

These comparative tests then showed those files which gave the most satisfactory results with soft steel to be frequently far less efficient in the case of cast iron or other materials, and *vice versa*. Another result of these tests was that files that were ordered by the manufacturer for a given metal would very rarely prove the most suitable and satisfactory for the metal in question, which warrants the inference that file manufacturers possess an insufficient knowledge of the best method of cutting files for a given metal. A further result of these tests is the fact that files should always be tested on the material in connection with which they are to be used, instead of being tested exclusively on cast iron, as according to previous practice.

ILLUSTRATIVE CURVES

The sets of curves represented in Fig. 1 are characteristic of five different files. Curve 1 is typical for a bad file with low cutting speed and rapid wear, while curves 3 and 5 are characteristic of medium and good files respectively. Curves 2 and 4 are interesting insofar as they show that higher cutting speeds are frequently connected with a rapid wear, a long life being of more importance for gaging the possibilities of a given file. The moment at which the file is worn out should, therefore, be included in the curve. If, for example, the test had been discontinued with a wear of 50 cubic inches, files 2 and 3 would have been considered as the most satisfactory. Nor is the price characteristic of the quality of a file, as 2, which had been turned out by the same factory as 4, was actually considerably more expensive than the latter.

Fig. 3 comprises the curves of the front and back (*a* and *b*) of different files. In none of the tools tested were the front and back found to be of uniform quality. Curves 4a and 4b show to what amount these departures may rise. The back, in fact, showed a life three times as long as the front (60,000 as against 180,000 strokes), while giving an output about 15 times as high (8

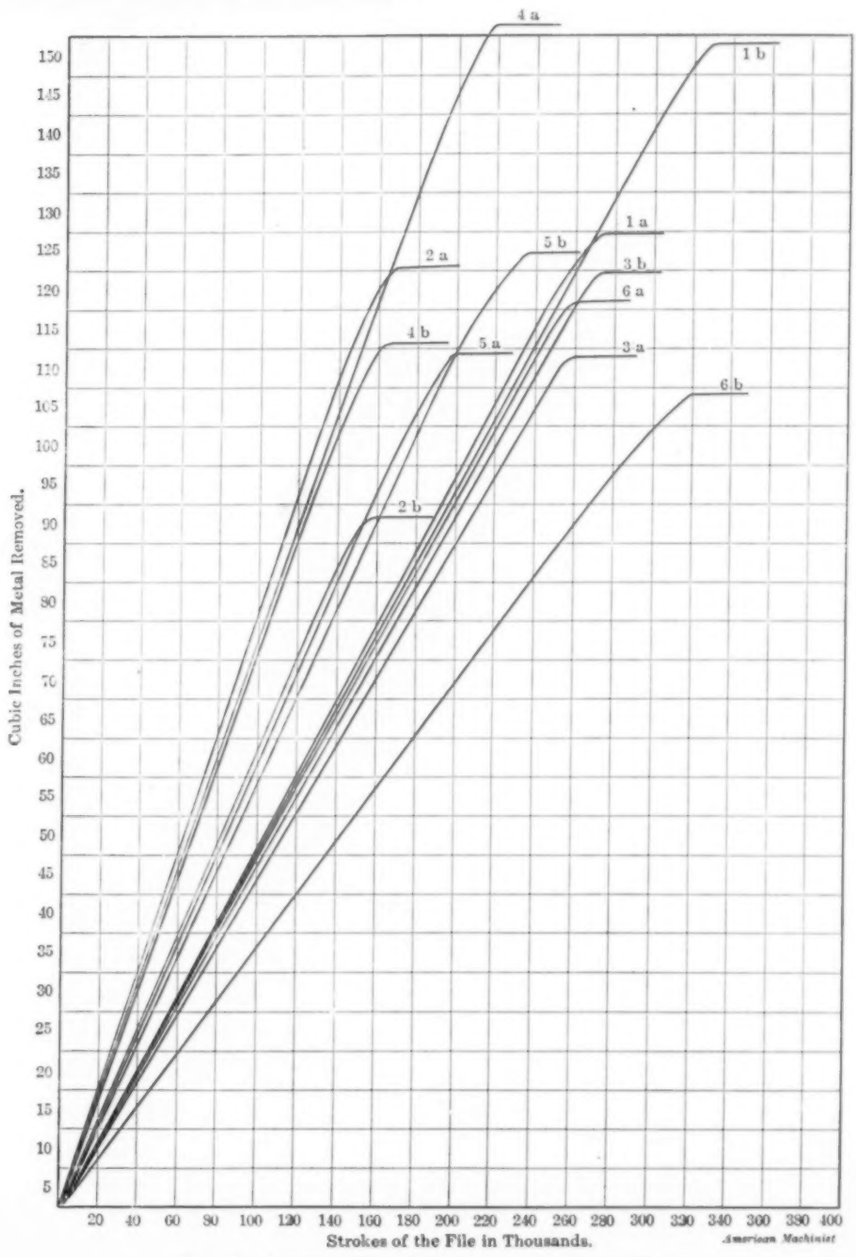


FIG. 3. CURVES FROM FRONT AND BACK OF FILES

against 125 cubic inches). No adequate explanation of this lack of uniformity can so far be given. The fact is possibly to be ascribed to different causes, such as a reduction in the sharpness of the cutting chisel, lack of uniformity in hardening, and the wear of the side previously cut on its support.

The curves strikingly illustrate the necessity of mechanical testing. Though the differences observed between the best and the least satisfactory files are still considerable, all six files can be safely said to be quite efficient. The six files in question were made from crucible steel.

A comparison of the curves will show the abruptness with which the cutting qualities are bound to cease. Most engineers would be inclined to suppose a file to lose its sharpness gradually; however, the sudden deflection of the curves at their top into a horizontal line shows the cutting possibilities to relax practically without any transition and to cease quite abruptly.

It should obviously be noted that the working conditions of the file on the testing machine, and in the workman's hands respectively, are strikingly different. As in the former case, the pressure exerted on the sample always remains constant, no further effects can be obtained by an increase in the pressure as produced voluntarily by the workman. However, this uniformity of working conditions is quite indispensable for the sake of comparative tests.

The following points can be taken as characteristic of the behavior of files: The steeper the curve, the more favorable is the performance of the file. On the other hand, the curve of a satisfactory file should be of proper length in order to show an adequate life. A curve ascending steeply in the beginning in order rapidly to pass into a horizontal line (thus indicating the fact of the file becoming blunt) is characteristic of a tool which, though being of sufficient sharpness, only shows an insufficient life. On the other hand, an extensive flat curve will characterize a file of insufficient sharpness though of sufficient life.

The criterion of a satisfactory file thus seems to be in possessing a long and steep curve.

Shop Secrets—Satisfied Customers

By John R. Godfrey

Shop secrets are very largely imaginary advantages because good men do not stay in one shop forever. And the satisfied customer is the only kind that really pays.

The shop secret is a peculiar institution. Sometimes it is based on the idea that if the other fellow knew how we made our sausage stuffer, he might be a more vigorous competitor. The chances are, he is meeting our prices now, which indicates that he must be making them as cheaply as we are, so that his methods must be as good as ours even if different. And there are nine chances out of ten that we wouldn't use his methods if we knew them, nor he ours, if he knew all about them. And the chances are that we all know all about the other fellow's way anyhow, and prefer our own.

This method of ours has cost us a lot of money to develop. Meanwhile, the other fellow has been standing still and we've been getting all the business. But have we?

Isn't he still in the ring, wearing clothes as good as ours and didn't we see him in his auto last Saturday at the ball game? Then somebody must have told him our way, because no one else could have thought of it.

Shop secrets are largely creatures of the imagination unless in a business so small that one man can do all the work and use all the secret methods.

When a workman leaves our shop, no matter what the reason, he carries in his head some of our ideas and methods. He can't help it. Some men carry more than others, some can impart more than others, but it doesn't do to fool yourself, as some do, into believing that the average workman wouldn't know an idea if he met it face to face. Don't get the idea that all the brains of any establishment are in the office, no matter who says so. If they were, there wouldn't be nearly so many successful businesses as there are today.

I was in a large shop recently and saw a new material being used for a certain part of a well known machine. "Sh! not a word, we aren't advertising that. The other fellow will catch on soon enough."

Strangely enough, I saw the same thing in the other fellow's shop the next day—said they had been using it for some time. The other fellow had caught on, but I wonder which one was first.

So I've come to this conclusion. When you get a new scheme, build a new machine or do something worth while, don't try to be over modest. Talk about it; let others talk about it—and use it after it's been talked about with your name hitched on to it.

I can name several types of machines which are today known by the names of men who do not claim to be the inventors. These men simply saw the possibilities of these machines, built them, talked about them and made other people talk, and they bear their names as long as they are used. And many users never heard of the original makers. If they had not been so backward in proclaiming their wares, it would have been a different story.

Only Satisfied Customers Are Good Customers

The old idea that if you could sell a machine to a man it was up to him to make it go, has gone by and it is well.

I know that some of my friends who have been stung with unreasonable customers will wince a bit. But all the same, it is better to spend good money to make a machine go or even take it out, than to let him keep it and not make it go right.

A machine in the hands of a dissatisfied customer is always lying in wait to stab you in the back, and you never know when it happens.

Either make it go to his satisfaction or don't let him keep it at any price. You can't afford to.

In this connection I know of one case where a builder goes so far as to take prospective customers to other shops in the town, building the same line of tools. After showing them their machines and their methods, they often carry the prospect to another shop and turn him loose, especially if he hesitates on placing an order. They want him to see the others and make his own selection. This may seem to be taking unnecessary chances in losing a sale, but it hasn't often worked out that way.

They very naturally tell him all the good points about their machine before they turn him loose, but they do not want him to buy a Jones and then tell everyone he wishes he had bought a Brown. It's better to miss a sale once in a while than to have customers who are not wholly satisfied.

J. T. Doan, in an address before the National Machine Tool Builders Association, gave these examples of the varying import duties upon machine tools when shipped into some of the leading countries. The figures are approximate and apply to the shipment of a 14- or 16-inch lathe, weighing approximately, 1800 pounds:

Germany	$15.60
France	38.00
Denmark	24.00
Austria-Hungary	40.00
Italy	14.00
Russia	107.80

Making Gun Stocks and Receivers

By Frank A. Stanley

How the Hopkins & Allen gun stocks are turned and finished and the receivers machined for their various parts.

The manufacturing equipment includes stock turners, and inletters, milling machines and fixtures for receivers, special multiple-spindle machines for forming peculiar operations on the receivers with the aid of ingeniously designed holding attachments.

In an earlier article on the methods employed by the Hopkins & Allen Arms Company, Norwich, Conn., a number of illustrations were presented, showing the processes followed by this concern in the production of shot-gun barrels. The present article will be devoted to some of the methods utilized at the Hopkins & Allen plant in making gun stocks and frames or receivers.

The Stock Turning Department

Two views in the stock department are presented in Figs. 1 and 2. Two grades of wood are used here, American black walnut and English walnut, respectively. The blocks for the stocks are cut out on the band saw approximately to size and shape and then in the lathes shown in Fig. 2 are turned to correct form. One of these stocks about finished will be seen in the first machine in the half-tone with the master stock to which it is turned in the upper part of the lathe. The stock turners operate with a master stock made of iron against which a guide wheel of the same diameter as the cutter head is constantly held during the turning operation, the result being that the outline of the model is accurately reproduced in the wood stock.

The controlling wheel, which bears against the iron stock is visible at the upper part of the frame and a portion of the cutter head which machines the wood stocks to the same contour will be seen below and to the rear of the work.

Inletting Machines

The machines in Fig. 1 are known as rotary inletting machines and are used in making various cuts in gun stocks, shaping revolver butts, etc. As will be noticed, the heads with the routing tools and the pilots are carried on rails swinging about a central pivot in the form of a turret, which is secured when rotated to position, by a lock-bolt in the column to the left. The table carrying the work is really a removable fixture which is mounted on trunnions to admit of angular adjustment in the vertical plane, thus providing for sloping cuts, and it carries an indexing guide block or former for the different sets of tools on the turret.

With this arrangement the operator, after setting his stock in place, can very readily swing one tool after another to position, take the cut, index for the next cut and so on. As he pulls down each cutter head to working position, a spring latch on the face of the slide engages with a stop on the face of the saddle and holds the cutter down to the required

Fig. 1. Rotary Inletting Machines for Shot-gun and Rifle Stocks

level, thus making it unnecessary for him to keep one hand on the vertical lever during the cut.

Routing Tools

A number of gun stocks showing a few of the inletting cuts which are required, are illustrated in Fig. 1, and the sketch,

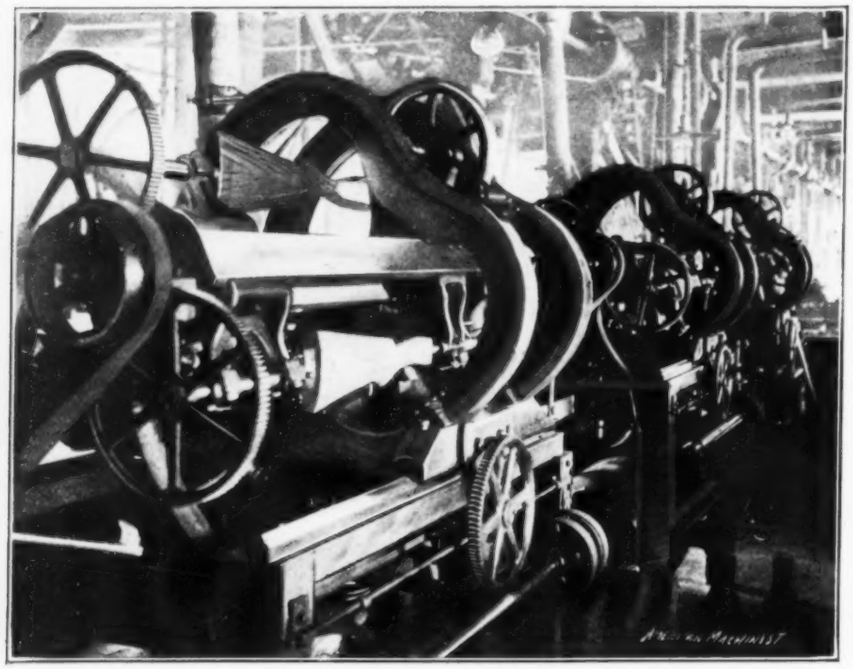


Fig. 2. Hopkins & Allen Gun-stock Turning Department

Fig. 3, shows a typical routing cutter as used in these machines.

This tool is made with a single keen cutting lip, which is formed on a body with eccentric shank, in this case the degree of eccentricity being 1/32 inch, giving a maximum throw of cutter edge of 1/16 inch. The tool is held in an eccentric sleeve in a concentric hole in the spindle, so that by turning the tool in its holder any required amount of eccentricity from zero to 1/8 inch may be

Fig. 3. Routing Cutter for Gun Stocks

obtained, thus giving the cutter edge the necessary clearance in operation, and also permitting it to cut slots in one pass to any required width within the total range of the eccentric cutting edge.

Receiver Parts

The receiver and parts for a Hopkins & Allen double barrel, hammer gun are illustrated in Fig. 4, where the receiver body or frame itself and the members which it carries when finished, are shown in both rough and completed condition. The side plates and other parts are held so close to gage in the machining operations that they will assemble in the frame just as they come from the machine. The names of these parts as referred to in the halftone by numbers are as follows: (1) frame forging; (2) frame with lug, water table, sides and recoil plate cuts made; (3) frame with extension, top lever, and top lever spring cuts made; (4) frame finished; (5) frame with parts assembled as they come from machines; (6) tumbler blank and finished tumbler; (7) right and left hammers; (8) bridle forging, R. and L.; (9) bridle finished, R. and L.; (10) trigger blanks and finished triggers; (11) mainspring seats; (12) fore-end forging and finished fore-end; (13) sears, right and left; (14) side plates, right and left, finished from punching; (15) mainspring followers; (16) trigger plate forging and finished trigger plate; (17) right and left side plates showing action.

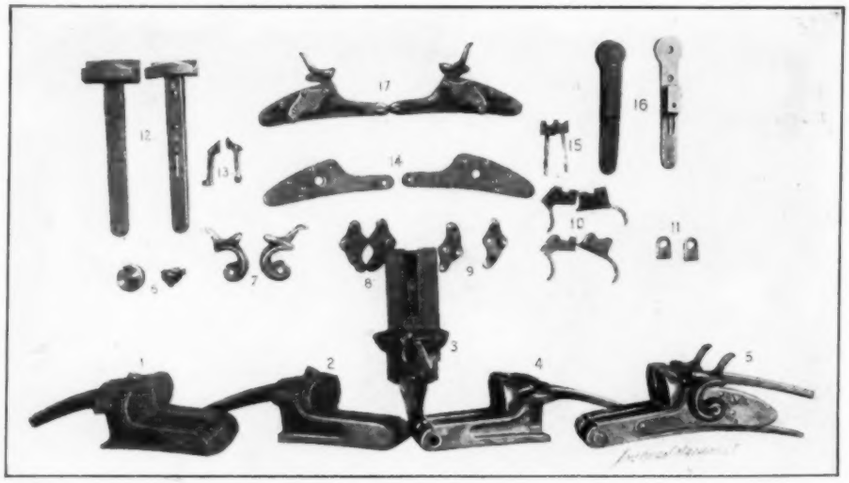


Fig. 4. Gun Receiver and Various Parts in Rough Forging and Finished

Some Milling Fixtures for Receivers

Some single-gun receiver-milling fixtures are represented in Figs. 5, 6 and 7; these being of the same general form as used for the double-gun receiver shown in detail in Fig. 4. In milling this piece from the rough drop forging, the work goes first to a machine where a cut is taken crosswise with form cutters and the contour brought out correctly. The fixture in Fig. 5 mills what is known as the lug slot, which receives the lug on the barrel, and owing to its importance, it is used in subsequent operations as the locating point for the work. In Fig. 6 this forging is shown located by this lug slot upon a tongue in the fixture, while another slot is being cut directly opposite. The forging while guided sidewise by the tongue, is wedged up from underneath against a stop on the fixture and is steadied by set screws at either side. A swinging clamp near the top of the fixture grips the body of the receiver during the operations in both Figs. 5 and 6, and thus adds to the rigidity of the piece during the taking of the cut.

Fig. 7 illustrates a pair of form cutters set up for milling the sides of the receivers, two forgings being held at a time in the double fixture while they are passed under the cutters. The general form of the work in these three views and the method of mounting upon the Brown & Sharpe millers will be obvious upon inspection of the engravings.

Another operation on the single receiver is illustrated in Fig. 8, where the Pratt & Whitney profiler is shown set up for taking a forming cut along the edge of the receiver forging.

A Horizontal Drilling Machine

The horizontal multiple-spindle turret machine in Fig. 9 is equipped with a

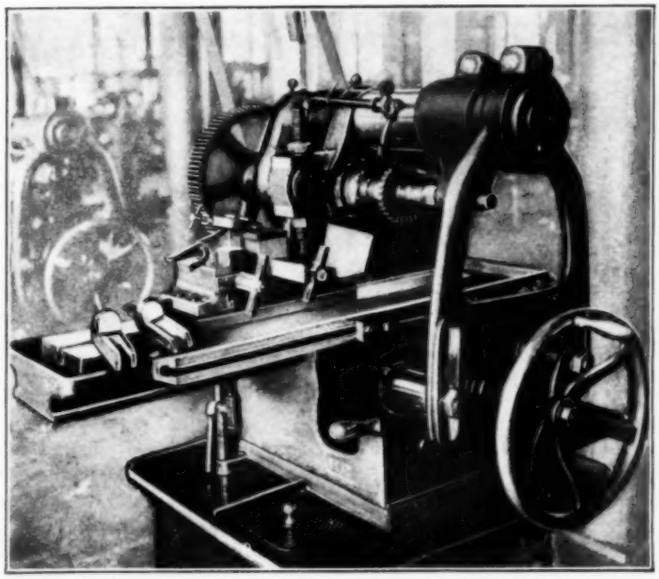


FIG. 5. MILLING LUG CUT ON SINGLE-GUN FRAME

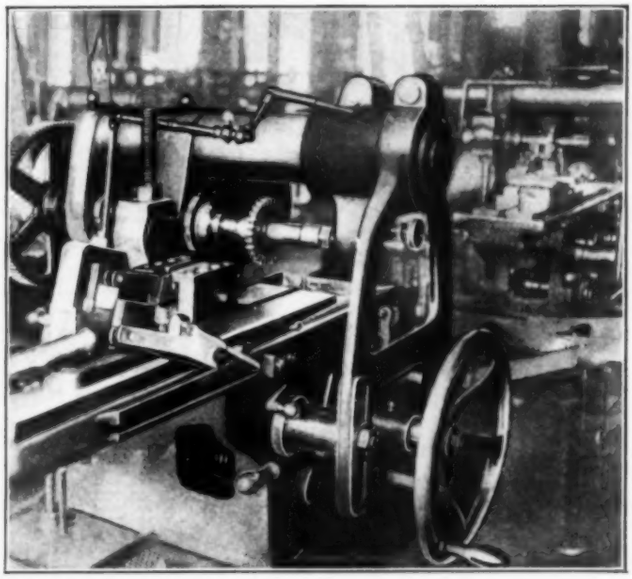


FIG. 6. TAKING THE MILLING CUT FOR THE TRIGGER PLATE

variety of special holding fixtures by means of which different gun parts are secured while being operated upon by various tools carried in the spindles. The latter are mounted in a horizontal rotating carrier and as each spindle is indexed into operative position, a clutch upon its rear end is engaged by the driving clutch at the left, which runs continuously, the spindles themselves remaining stationary except when brought one by one into working position.

One of the most interesting operations accomplished here is the machining of a curved seat forming the female member of the locking joint for the double-barrel gun. The male member of this joint known as a "doll's head" is formed upon a projection of the rib which extends along the barrels and its general shape is shown in Fig. 10 and at *A*, Fig. 11. This "doll's head" looked at in plan view is approximately circular in form, while viewed from the side it has a curving outline, the arc of curvature being struck from the center about which the barrels pivot when opening or closing

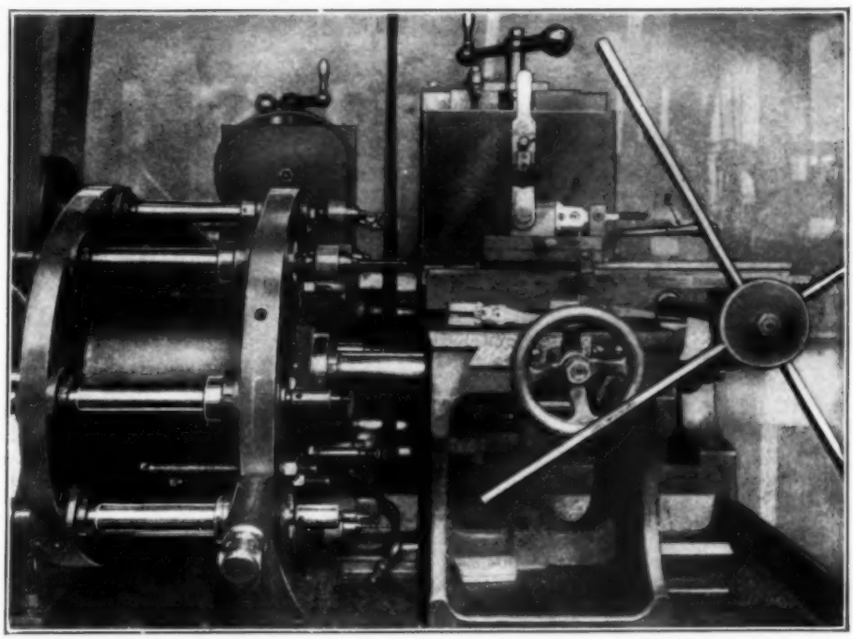


FIG. 9. EIGHT-SPINDLE ROTARY DRILLING MACHINE OPERATING ON DOUBLE-GUN RECEIVERS

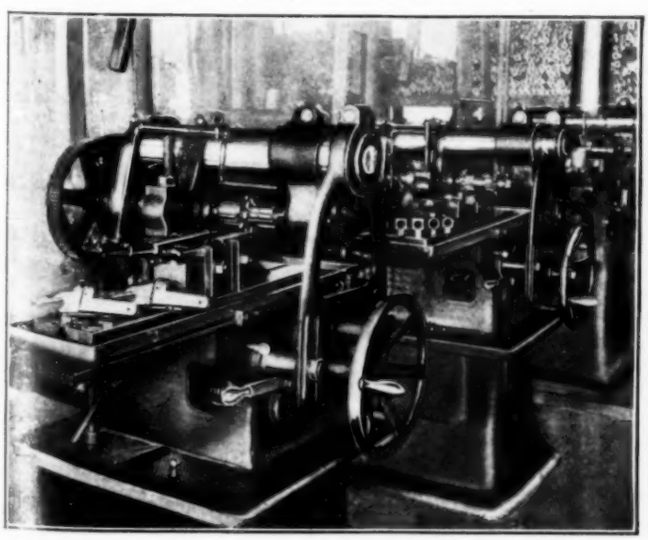


FIG. 7. MILLING SIDES OF RECEIVERS AND REINFORCED BREECHES

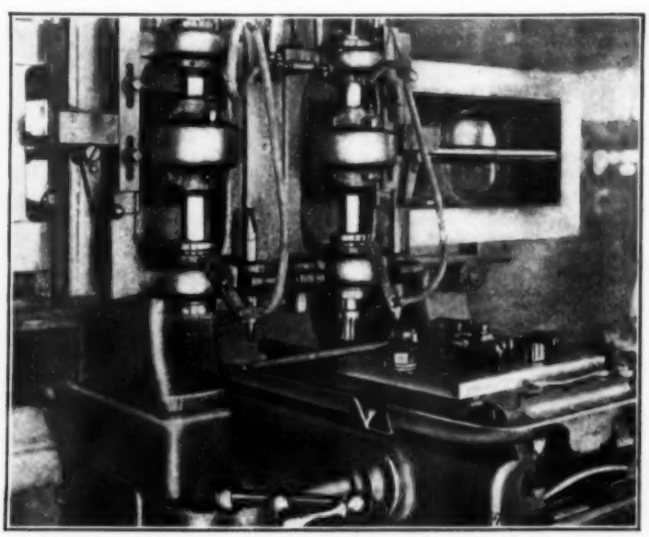


FIG. 8. PROFILING EDGE OF RECEIVER

the gun. To receive this member, the seat must be similarly curved, but to insure a perfectly tight joint which will tend as the joint is closed to draw the barrels back as firmly as possible, the arc or curve in the seat is struck from a center very slightly off from the pivotal center about which the gun breaks open or closes. Most mechanics would consider the drilling of a hole around a curve an exceedingly awkward undertaking; with the tools used in the machine in Fig. 9 it is a simple matter.

FIG. 10. HOPKINS & ALLEN 12-GAGE DOUBLE GUN, SHOWING "DOLLS HEAD" JOINT

MAKING A HOLE ON A CURVE

The gun frame or receiver, is held for the operation as shown at *B* in a fixture *C*, pivoted to obtain the proper radius, and first a twist drill in one of the spindles is run in with the work set at the proper angle so that the drill follows a course which in respect to the "bent" hole to be produced might be compared to the chord of an arc. Following this the hole is opened out somewhat by tools in other spindles and then a spherical-end mill with a small shank is employed in another spindle, the work in this case being fed to the mill by swinging the fixture about its center. In this way a curved path is followed, the radius of which is correct so that when the gun is later assembled, a tight, drawing fit will be assured in the joint.

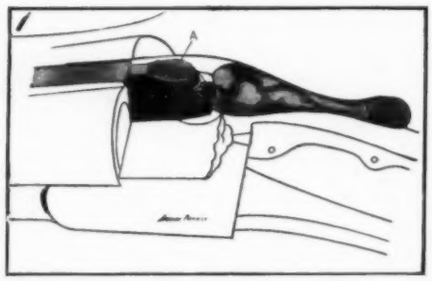


FIG. 11. SIDE VIEW OF DOUBLE GUN SHOWING "DOLLS HEAD" JOINT

The holes drilled directly into the receiver are put in with tools guided by bushings in the leaf *D*, which in Fig. 9 is shown swung up out of the way to allow the spherical-end mill to cut the curved seat. The handle by which the fixture is operated will be seen at *E*. The work is plainly shown in the open fixture and a finished receiver will be noticed on the cross slide which carries the fixture.

FACE GRINDING MACHINES

The row of machines in Fig. 12 are used in connection with Walker magnetic chucks for grinding the surfaces of a variety of thin, flat gun and revolver parts, such as triggers, side plates, hammers, etc. In the illustration the chucks shown are mounted on trunnions so that they can be tilted to receive the work and then returned to the wheel. The wheel used is of the ring type.

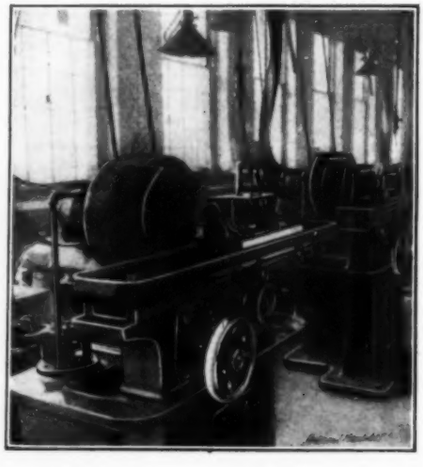


FIG. 12. GRINDING SMALL PARTS ON MAGNETIC CHUCK

Approximate Formula for Angles of Screw Threads

BY S. PEASE

In working a thread-milling machine it is necessary to calculate the angle of the thread (or helix angle) at the pitch-line diameter in order that the cutter head may be set over to the correct inclination. This is usually done by calculating the tangent of the angle from the formula

$$\textit{Tangent of angle} = \frac{\textit{Lead of screw}}{3.1416 \times \textit{pitch diameter}}$$

and then getting the angle from the table of tangents. Where such tables are not at hand, the following formula will be found to give accurate results in practice for any angle of thread up to about 13-degree angle, or for ratios of pitch to diameter of less than 3 to 4. These limits cover the great majority of cases met with in thread-milling machine practice and the formula is

$$\textit{Angle of thread in minutes} = 1080 \times \frac{\textit{Lead of screw}}{\textit{Pitch diameter}}$$

The results up to 13 degrees as above are always accurate within 4 or 5 minutes, which is nearer than it is possible or necessary to set the cutter head.

The time saved in calculating is considerable and I always use this formula in preference to the true one.

To show the accuracy of the formula I take 3 examples:

(1) A worm 2-inch pitch diameter 1-inch pitch by *true* formula tangent of angle $= \frac{1}{3.1416 \times 2} = 0.1591$.

Angle = 9 degrees 3 minutes;

by *approximate* formula angle $= 1080 \times \frac{1}{2} = 540$ minutes $= 9$ degrees.

Here the error is 3 minutes, i.e., 0.05 of a degree.

(2) A worm 3-inch pitch, 4-inch diameter by *true* formula, tan. of angle $= \frac{3}{3.1416 \times 4} = 0.2387$.

Angle = 13 degrees 26 minutes;

by *approximate* formula, angle $= \frac{1080 \times 3}{4}$ = 810 minutes = 13 degrees 30 minutes.

Error 4 minutes.

(3) Worm ½-inch pitch 2½ inches diameter by *true* formula, tan. angle $= \frac{0.5}{3.1416 \times 2.5} = 0.0637$.

Angle = 3 degrees 39 minutes;

by *approximate* formula, angle $= 1080 \frac{0.5}{2.5}$ = 216 minutes = 3 degrees 36 minutes.

Error 3 minutes.

A comparison of the time taken with both formulas will prove the value of the above as a time saver. The great thing to remember is, don't use the formula for angles above 13 degrees.

Design of Ball Thrust Bearings

By Henry Hess *

The way in which the surface forming the seat or ball race affects the efficiency and life of a ball bearing Various designs and points concerning them.

Much ingenuity has been expended in the design of ball bearings in general; the thrust type has come in for its due share.

Much ingenuity, possibly even more, has been expended in analysis of the ball thrust bearing; unfortunately, most is expended to prove or disprove a preconceived theory rather than confined to a dispassionate dealing with actual conditions.

On page 651, under the caption "Design of Ball Thrust Bearings," it is apparently clearly proved that the use of a spherical seat cannot and does not fulfil its intended purpose of evenly distributing the load over the whole circle of balls. It is true that this is somewhat softened down by admitting that "the purpose will be gained sometimes" under certain conditions.

In Fig. 1 the sketch used to prove this contention is reproduced. It is stated and clearly proved that when the ball at one side is heavily loaded by large P and the opposite ball lightly loaded by small p, that these two loads will not be equalized. No fault can be found with the statement nor the proof, beyond two fundamental ones: (a) Ball bearings do not start out with a heavy load on one side and a light one on the other; (b) It is not the function of the spherical seat to equalize unequal loads, but to prevent their formation.

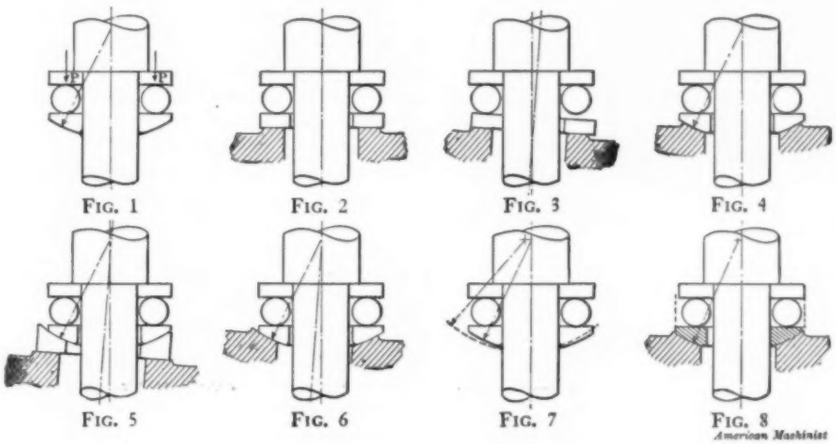


FIG. 1 FIG. 2 FIG. 3 FIG. 4

FIG. 5 FIG. 6 FIG. 7 FIG. 8

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DIAGRAMS IN CONNECTION WITH DESIGN OF BALL-THRUST WASHERS

Fig. 2 shows a thrust bearing without a spherical seat. There is absolute parallelism between the various supporting surfaces. The load acts centrally through the shaft. Each ball will bear an equal share of the load.

Fig. 3 shows in an exaggerated way the condition of affairs when the surfacing of the stationary support is not square with the shaft axis. It is clear that the ball at one side will receive the entire load.

Fig. 4 shows a spherical seat with the parts as they should be, not as they were wrongly shown in the reproduced Fig. 1. The flat ball race should fit the shaft; the spherical ball race should be bored to clear the shaft; the stationary seat should clear the shaft. There can be no question about the even distribution over all of the balls of any load acting centrally through the shaft.

In Fig. 5, the stationary seat is shown out of square with the shaft; the one ball-bearing race is provided with a spherical lower face that fits into a correspondingly cupped washer; this latter is free to move transversely on the stationary seat. It is clear that the parallelism between the ball races is maintained. In Fig. 3 that parallelism was lost. As the only difference between the two arrangements is the interpolation of the spherical seat it is clear that the latter fulfils its intended function of compensating for lack of parallelism and securing the same even load distribution that attends parallelism of the various surfaces.

Fig. 6 illustrates the condition when the spherical seat of the lower ball-bearing race is supported without the interposition of a cupped washer, but when the cup is formed directly in the housing. Again, there will be no disturbance in the equality of load distribution on the balls, provided that the center of the spherical cup coincides with the center from which the spherical race surface is struck. With this construction there will be no disturbance if the shaft is out of alinement in such way that its axis passes through the center of the spherical seat. This arrangement is widely used on centrifugal machines, such as sugar extractors, etc., in which the bowl is carried on a shaft whose weight is carried on a ball thrust and whose shaft is free to swing around a center that is the center of the compensating spherical seat.

Fig. 7 shows the condition that results when the spherical-seated race is not free to move transversely with reference to this shaft, as in Mr. Rennerfelt's erroneous design, Fig. 1, and when the center of this and the center of the spherical seat in the housing do not coincide. All parts cramp more or less seriously, depending upon the amount of the inaccuracy.

But if the spherical-seated race is free of the shaft as in Fig. 8, and as it should be, it can and will move crosswise to its seat. This presupposes that the balls roll on flat tracks, as shown. Actually, where large carrying capacity is required, both ball tracks must be grooved to a curvature but slightly larger than that of the balls. As such grooves will not permit of the crosswise movement of the one race with relation to the other, the arrangement of Fig. 5 with the separate cupped spherical washer should be employed whenever it is difficult or unduly costly to secure exact parallelism of all surfaces and exact coincidence of the concave and convex-spherical seat centers.

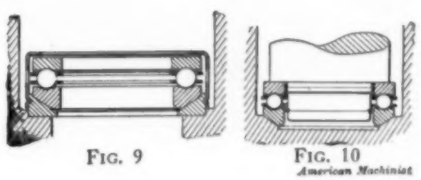

FIG. 9 FIG. 10

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DESIGNS OF HESS-BRIGHT BALL-THRUST BEARINGS

In Fig. 9 is illustrated a ball-thrust bearing as made by the Hess-Bright Manufacturing Company, that, in one unit handling whole, comprises the two ground races, the balls, the lower race with its spherical seat and the spherically cupped compensating washer, all held together by a surrounding sheet-steel cage. The same combination, minus the cupped washer and the cage, is shown as Fig. 10.

* President, Hess-Bright Manufacturing Company.

Results Obtained in Cutting up Steel

Special Correspondence

A series of tests conducted on a recent type of cutting-off machine with various grades of steel.

Tests show marked advance in construction of cutting-off machines.

Much progress has been made in recent years in the cutting up of materials in shapes that are suitable for machining in various ways; especially is this so when cutting steel of various grades. The machinery that is used for this purpose has been greatly improved and results are now obtained that would have been considered truly remarkable but a short time ago.

The George Gorton Machine Company, of Racine, Wis., recently placed an improved 2B cutting-off machine on the testing floor, and ran it for several days on 6-inch round steel bars of 30-point carbon, in order to get some absolute data on the work that the machine was capable of doing. This machine is shown in Fig. 1, at the instant that the cutters had severed the end of the bar. The pyramid to the right of the machine shows 28 6-inch round, 30-point carbon-steel gear blanks that were severed in exactly one hour with one man and a helper to operate the machine. It was clearly demonstrated that on this quality of stock, which is fairly hard, short pieces, say from 1 to 6 inches in length, the above rate could be maintained for hours on 6-inch bars if they were used in 18- or 20-foot lengths. This would give quite a quantity of short cuts and only a minimum amount of time would be consumed in placing bars on the stock carriage.

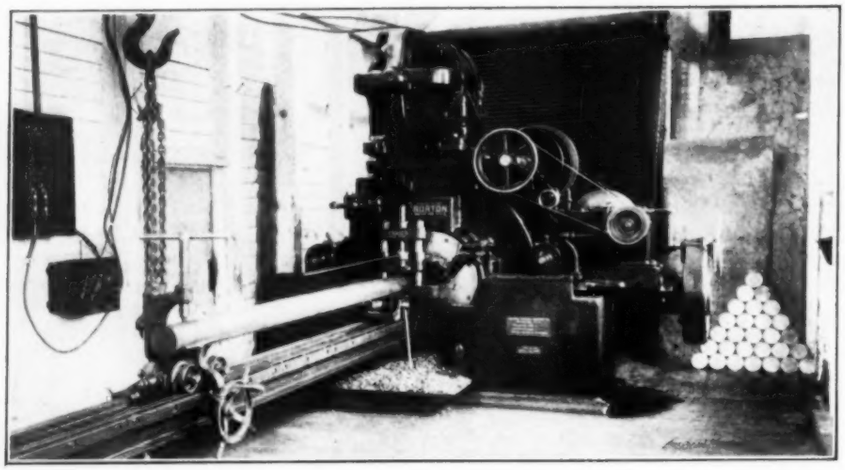


FIG. 1. GORTON CUTTING-OFF MACHINES AS USED IN TESTS

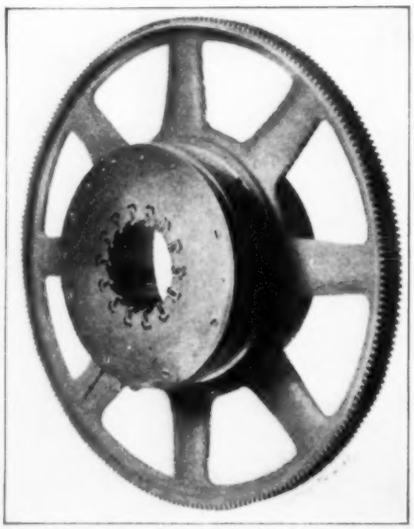


FIG. 3. DRIVING GEAR AND CUTTER

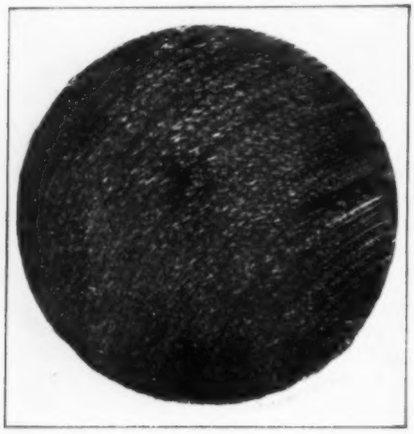


FIG. 2. DISKS OF 30-POINT CARBON STEEL 6 INCHES DIAMETER. TWENTY-EIGHT CUT IN ONE HOUR

MOTOR DRIVE

The machine was driven by a 20-horsepower, 2 to 1, variable-speed motor, operating on 220 volts direct current. This motor is shown on top of the machine and directly connected to it. The chip pan shown in front of the machine is 1½x3 feet 8 inches deep. The accumulation of chips therein represents about three hours' work.

When producing the above output the cutters were operating at 75 feet per minute. This is by no means an extremely high speed, as with the motor equipment shown, the cutters may be operated at any speed between 40 and 100 feet per minute.

CUTTING TIME

The feeding in of the stock bar and clamping it ready for a new cut requires but four or five seconds; hence, there is practically no loss of time in measuring off the desired length. The desired length is measured with the arrangement shown at the rear of the stock carriage.

On the basis of 28 cuts per hour, as obtained above, the cutter blade must actually sever each piece in approximately 75 seconds; the balance of the time being consumed in returning the carriage by power, clamping the bar, etc.

Bars have been repeatedly cut like the above, namely, 6-inch round 30-point carbon steel in 45 seconds, without damage in any way to the cutters or the machine. When operating on extremely soft stock, that is, from 10- to 15-point carbon steel, a time limit of 1½ minutes would be the maximum per cut on 6-inch stock.

SPECIFICATIONS BEATEN

On a machine of this type that was recently sent out, it was specified that it

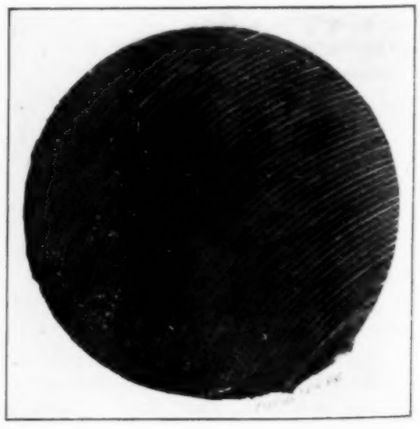


FIG. 4. DISKS CUT WHEN MAKING CHIPS IN FIG. 6. FIVE AND ONE-HALF INCHES DIAMETER

should cut extremely soft stock, per day of 10 hours, 270 pieces of 3-inch round, 240 pieces of 4-inch, 210 pieces 4½-inch, 190 pieces 5-inch, 165 pieces 5½-inch, and 150 pieces of 6-inch round stock.

In testing the machine two men operated it and one man removed the stock that had been severed. A crane was also used to keep the machine supplied with bars, which were from 18 to 24 feet long. It might be mentioned here that it required the constant service of the crane to do this. The length of cuts were from 2 to 4 feet, and the number of cuts per 10 hours included the time necessary to change cutters when they became dull.

These requirements were not extraordinary, and exclusive of the time required to change cutters, it was found that on some sizes of this stock the specified number of cuts could be almost doubled, when working under the most favorable conditions with a trained gang to operate the machine. Thus it would not be difficult to produce the required number of cuts under actual working conditions.

Sample Cuts

In Fig. 2 is shown one of the 30-point carbon-steel disks, 6 inches in diameter, that was cut in 45 seconds. One secret of the success of this fast cutting is the absolute elimination of chatter or vibration in any portion of the machine. The main factor in removing this chatter and vibration is the extremely large gear wheel that is used for the drive, and the locating of the cutter in the center of the hub of this wheel. This gear wheel and cutter are shown in Fig. 3.

In Fig. 4 is shown a 17-point carbon, 5½-inch round steel disk that was cut on this machine in 1¼ minutes, or 75 seconds. In Fig. 5 will be seen the chips that were made in making this cut. The inch rule under the chips shows their comparative size, the largest of them measuring 5/16 inch on the face and about 3/32 inch thick.

Fig. 5. Chips Made When Cutting 17-point Carbon Steel

Fig. 6. Chips Made When Cutting 90-point Carbon Special Steel

Hard Steel Chips

The chips shown in Fig. 2 were made when cutting on extremely hard steel of a special composition that was used for gear stock. The bar was 5 inches in diameter and 90-point carbon. The cut was made in five minutes, which is about the maximum speed that could be obtained on that extremely hard and tough steel. The largest of these chips measured ¼ inch on the face and was about 1/16 inch thick. That the chips were red hot when leaving the cutter is shown by the temper color that they obtained from falling into the cooling liquid and quenching.

Tools for Telephone Parts

By W. F. Hoffman*

The accompanying halftones illustrate a milling fixture and a number of drill jigs used in manufacturing telephone parts.

In Fig. 1 is shown a fixture used for holding the receiver cups while milling off the ends of the cores of the coils as shown at *A*. The distance between the face of the cup and the end of the coils is accurate to within a couple of thousandths of an inch, therefore this operation is done after the different parts are assembled to get the desired result. This work is done on a Whitney hand milling machine. The piece is held in the fixture by means of pointed screws which enter the hole in the stem of the cup as shown at *B* and clamp it in position.

*Superintendent, American Automatic Telephone Company.

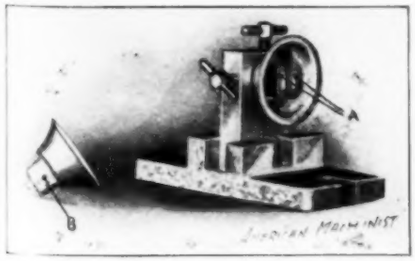


Fig. 1. Fixture for Milling Telephone Receiver Cups

In Fig. 2 the drill jig at *C* is for relay armature *C'*; the general construction of this jig will be readily understood. At *D E F* is shown a group of jigs used for drilling fiber and rubber terminal blocks; *D* showing a jig partly opened, with a fiber block *D'* in position. *E* is the same kind of a jig closed, with a fiber block *D'* in position ready for drilling. *F* is the same type of jig, only the drill guide holes are put through the lid to the exact size and are not bushed. The lid is of tool steel and hardened. This type of jig is satisfactory where the limits of accuracy are not very close.

The jig for drilling the holes in the receiver hook *G'* is shown at *G*. It is very simple in construction, yet efficient. A box jig is shown at *H* for drilling the holes in piece *H'*. With the exception of this last jig, very little trouble is experienced in keeping these jigs clear of chips and dirt, owing to their open construction.

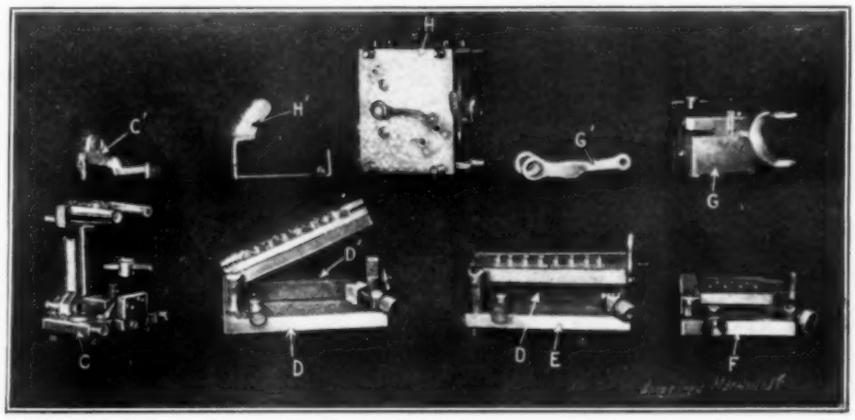


Fig. 2. Drill Jigs for Telephone Parts

New Cincinnati Planer Shops

Editorial Correspondence

A new shop, part of the Oakley colony, with admirable distribution of light and having a departmental arrangement designed to handle product with the least lost motion.

Some of the interesting methods used in building planers.

The latest addition to Oakley colony of Cincinnati manufacturers is the Cincinnati Planer Company, a general view of its shop being shown herewith.

A careful examination of this view will reveal many interesting things. The high central bay is tapped by a monitor skylight running the entire length of the shop, while each side of this, from the monitor roof to the top of the side bays, is a continuous glass skylight set at an angle of about 20 degrees and shedding a flood of light into the central bay. In addition to all this, the walls of the side bays have a very large proportion of glass. As clearly shown by the illustration, this gives a remarkably good distribution of light.

At the further end of the shop and just outside the door, is the casting storage, which is served by a crane running crosswise of the building. This takes castings from a car which can be run up a spur track outside at the left, the whole length of the shop.

Castings enter at the further door and are at once taken in hand for the first operation. If planing, they go to the left, unless it is work for the large planer seen at the extreme right of the central bay. If turning, to the right-hand corner, which contains the lathe department and handles the chucking and turning work.

As the parts progress toward completion they go to be assembled in their proper departments. The small planers are assembled at the left while the larger sizes are kept at the right and the very large machines in the center, to be handled by the large crane. Smaller cranes serve the side bays. Completed machines are loaded into the cars which come right into the shop on another spur, as shown.

Power Distribution

Power is distributed by the group drive system, with motors of various sizes. These motors are mounted on hollow concrete stands, as can be seen, getting them up out of the way and yet being much more get-at-able for attention and repair, than as though they were located on the girders above. Sections of shafting on both sides of the end of the bay next the foreground are for testing or "running off" planers of various sizes; the small ones being at the left as before noted.

It will be noted that the large planer at the extreme end of the bay sets at quite an angle. Another large planer is to go in this side of it, and will be set at a lesser angle to the bay. This is the method used in setting up screw machines to allow the bars of stock to be handled in a shorter space and is for exactly the same reason.

The heavy tools such as horizontal boring machines and radial drills are located in about the center at the left. On the right, not shown in the engraving, is an extension on the side bay for a distributing tool and stock room. The wash room, lockers and toilets are also on this side and just beyond the tool crib.

The artificial lighting is by the vacuum electric light, and gives excellent distribution in spite of being so high in order to clear the cranes.

All power comes from a central station which will supply the colony. This service includes electric current for power and lighting, hot water for heating and washing, cold water for drinking as well as for washing, and compressed air. The sanitary drinking fountains, without cups, are provided throughout the shop.

The floors are made up with a foundation of 6 inches of cinders, an 8-inch covering of concrete in whic oak sleep-

Fig. 1. General View in the New Plant of the Cincinnati

ers are embedded. Next a tar coating is put over the concrete and an oak floor 1⅝ inches thick fastened to the sleepers. Last comes the top floor of ⅞-inch oak, making a very substantial and satisfactory flooring. The heavy machines all have concrete foundations.

Every piece of a machine carries a number and a blueprinted list is kept in both the drawing room and the tool and stock distributing room. The names are arranged alphabetically for each machine and should a piece be known by two names in this or other shops, both names appear on the list, but both carry the same number. As an example we may cite "apron" and "harp," the swiveling base carrying the clapper box. This appears under both headings so that whichever a man calls it, he finds just what is wanted without delay.

A Simple Shop System

Each lot of any certain piece is tagged with a cloth tag as soon as it comes into the shop. This tag simply contains the piece number, lot or job number, number of pieces wanted, drawing number and date. This gives the workman all necessary information and he immediately secures the proper drawing and proceeds with the work.

Any special fixtures which are used on this piece bear the same number as the drawing and are kept in the tool crib which is centrally located. This tag remains with the work until it is completed and gives all necessary information in regard to it at all times.

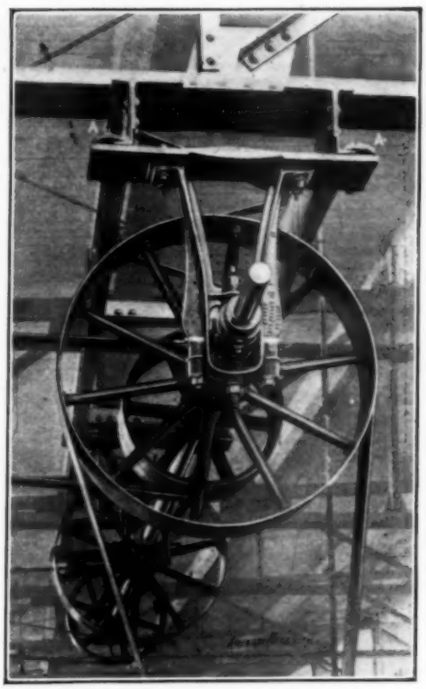


Fig. 2. The Line Shaft

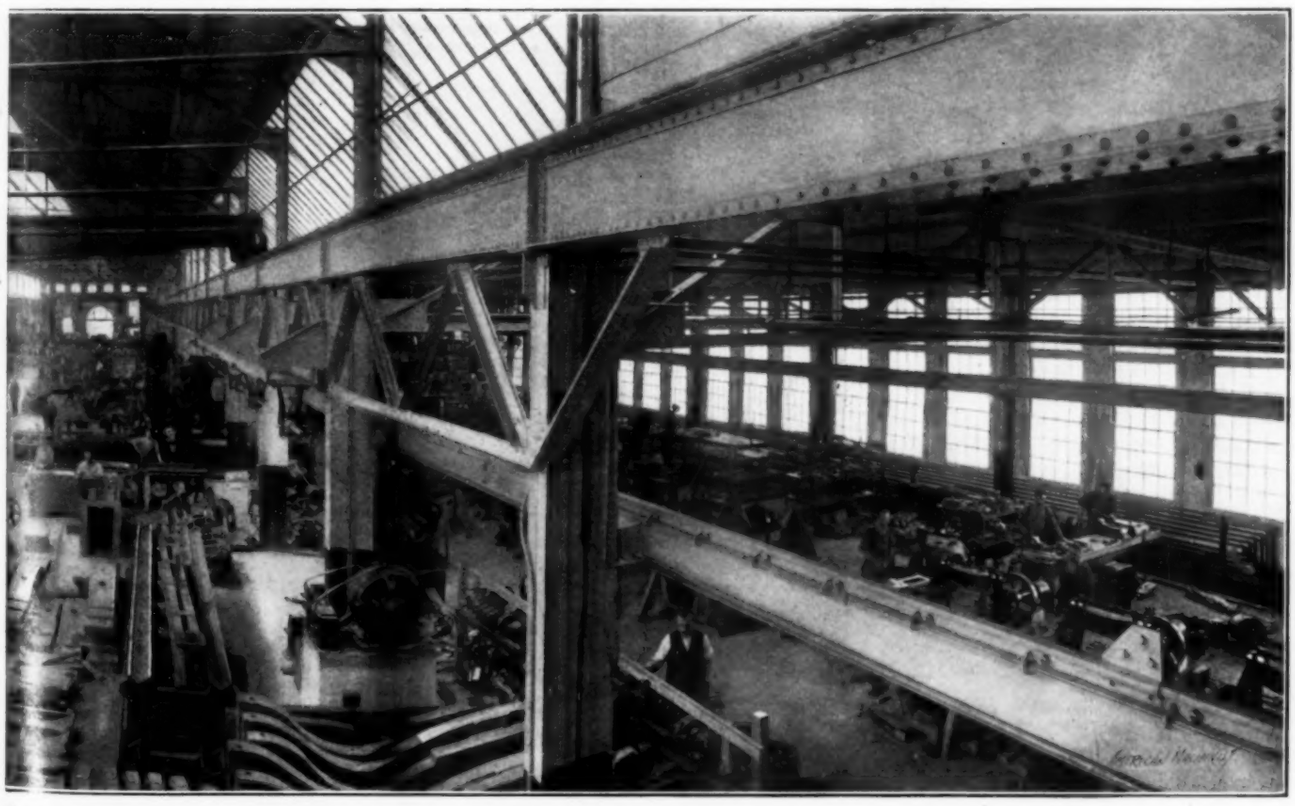
The drawings show exactly how many screws, bolts, nuts or keys are needed and each piece of this kind carries a number so that the assembler can easily secure from the stock room exactly what is needed for each job. A sample board with the pieces correctly numbered assists both the workmen and the stock keeper in knowing exactly what is wanted. The stock bins for standard small parts such as taper pins, bolts, etc., are plainly marked with a "minimum" number and the number to be ordered. When the stock is reduced to the minimum allowed, the stock man at once orders the number specified.

The Overhead Work

Fig. 2 shows the way in which the line shafting for group driving is supported; channel beams are riveted to the cross members of the roof structure and the hangers are clamped to these as can be seen. Fig. 3 shows the plates which are fastened to the channel by the clamp *A*, as shown in Fig. 2. Fig. 3 shows the upper side of two styles of cross pieces, these being for counter shaft and hangers having a single bolt hole in each leg, while *C* is for the line-shaft hangers as indicated in Fig. 2. The ribs on the upper side of the plates serve the double purpose of securing added strength and also preventing the turning of bolt head while the hangers are being fastened in place. This makes it easy for one man to put them up as he need only pay attention to the nuts below, knowing that the bolt head is prevented from turning while he is at work on it. Both of these allow considerable latitude in the spacing of hanger-bolt holes and the method of clamping allows easy adjustment of hangers into any position.

Setting Gear Cutters

Fig. 4 shows an interesting gear-cutting kink, and incidentally shows the extreme care that is taken to secure gearing which



Pl ner Company at the Oakley Colony, Cincinnati, O.

shall be as nearly right as possible to secure silent running. The piece shown in position on the mandrel is carefully turned to the exact bottom diameter of the gear to be cut. This makes it an easy matter to set the cutter to the correct depth for each gear and the operator has nothing to do with outside diameters or pitch line. The rack shown against the wall has been made specially to hold these cutter-setting pieces, which are suspended by wires from the iron pipe from which the framework is made. This system has been in use for some time and is giving excellent satisfaction.

On long planer beds it is necessary or at least best for manufacturing reasons to make the bed in two pieces. Fig. 5 shows an extremely interesting method of securing alinement in such cases and also indicates the extreme care taken by the Cincinnati Planer Company to secure accurate work.

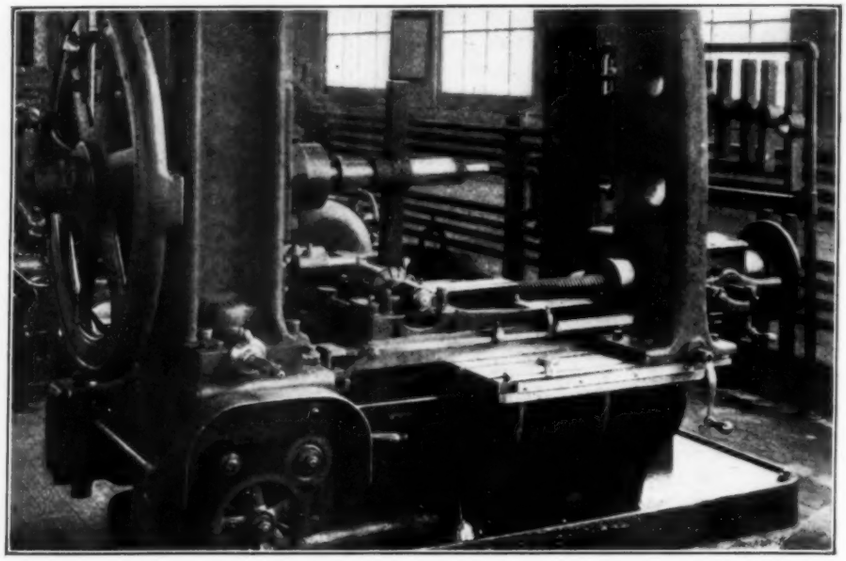


FIG. 4. SETTING THE GEAR CUTTER

FIG. 3. THE HANGER PLANT

locating pieces are then placed in the two V's and the holes drilled in the end of the bed on a horizontal drilling machine. The locating pieces *A A* are then reversed so as to bring them on the other side of the fixture and it is then placed in the V of the other part of the bed, which is then drilled in the same way. This locates the various holes exactly opposite each other without regard to their being symmetrically arranged and insures alinement when they are assembled.

LIFTING DEVICE

A very ingenious lifting device for handling planer, boring mill and similar tables is shown in Fig. 6. This consists of a forged eye having a straight

TESTING THE SQUARENESS OF THE END OF THE BED

After the V's are planed the testing fixture shown is placed in position in the right-hand V and is turned so as to indicate whether the surfaces touched by the pointer of the dial indicator are at exact right angles to the V. The testing fixture is then placed in the other V and the operation repeated, and in this way it is easily possible to detect very minute errors in alinement. Extreme care is used in setting these beds before milling the ends so that there is usually no difficulty whatever in this respect.

JOINING BED SECTIONS

The two pieces of the bed are first planed and the V's finished. Then the drilling fixture shown at the left of Fig. 5 comes into play. The hardened and ground plugs *A A*, are of the same diameter and fit into bushings in the upper part of the drill jig as shown. These

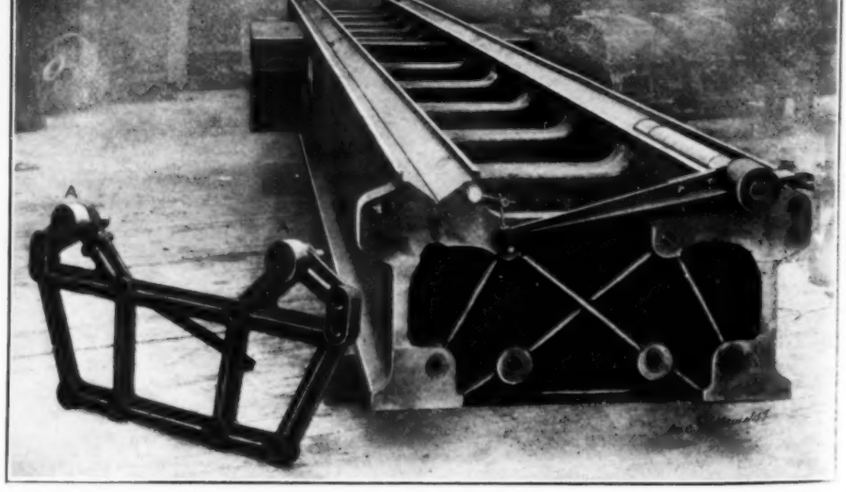


FIG. 5. MILLING FIXTURE FOR JOINTED BEDS AND TESTING INDICATOR

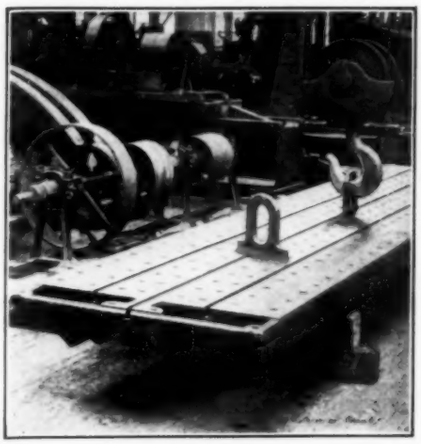


FIG. 6. LIFTING EYE FOR PLANER BEDS

piece across one end which is planed with a T-head to suit the T-slot used in the table. It is an easy matter to slip one or more of these into a large table in the correct position for handling it to the best advantage and there is no danger of slippage or of the piece becoming unbalanced while being handled by the cranes. This is a device which can be used to advantage in many shops.

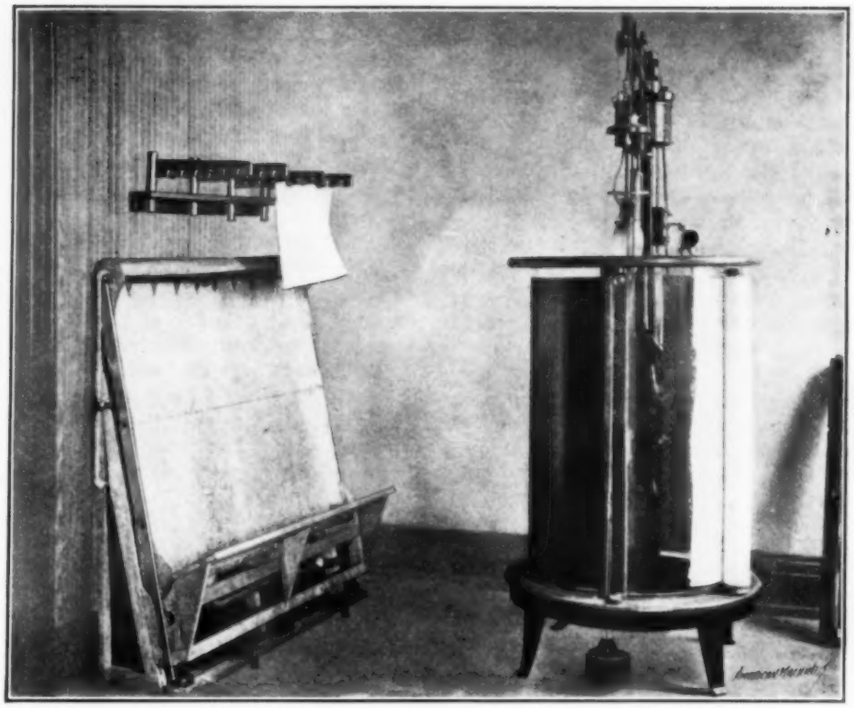


FIG. 7. PRINTING, WASHING AND DRYING BLUEPRINTS

Fig. 7 shows a very interesting corner of the drawing room which is in charge of Mr. Reston. After the blueprints have been made in the machines shown they are placed in the wash tank at the left and are held against the metal by the finger spring shown. They are divided into two sections so that it is only necessary to use half for washing small prints and this effects considerable saving in the amount of water used. The water is thrown on the print in a number of small streams and carried off by the trough at the bottom. The finger springs are also divided into two sections and each is controlled by a foot treadle shown near the floor. This makes it very easy to place a print in position to be washed as both hands are perfectly free to handle the print while the foot controls the springs which hold it in place.

The method of holding the prints above the washing frame is extremely convenient and is due to Mr. Reston. The arm which extends from the upright is built up of two comparatively thin sides and an opening in the center. This opening carries six brass disks about 1⅝ inches in diameter and so arranged that they rest on an incline which naturally throws them against the vertical surface at the back of the notch cut in the under side of the arm. They are perfectly free to move and it is only necessary to push the print into the notch in the arm, the weight of the brass disk holding it firmly against the print and holding it securely in place as can be seen at the right. This makes one of the most ingenious holding devices we have seen, and should be applicable in many other places.

We are indebted to the courtesy of Messrs. Quillen, Langan and Meier for the photographs and information secured in this interesting plant.

Drilling Speeds and Feeds

By John R. Godfrey

So many are experimenting with drilling speeds and feeds and securing such varied results that it may be interesting to compare some of the practice recently found in a number of different shops.

It is probably impossible to state with any degree of accuracy the percentage of high-speed steel drills in use, but it is probably safe to say that this is increasing rapidly where iron and steel are to be drilled so that we are safe in assuming that the drilling speeds given in the old tables are no longer applicable in modern practice. Instead of a cutting speed of 30 to 35 feet per minute, we find from 70 to 150 feet much more common and one of the well known drill makers recently assured us that he was running a ⅝-inch drill 1400 revolutions per minute, which gives something over 200 feet cutting speed. This, with a feed of 0.2 inch per revolution gives a drilling speed of about 30 inches per minute.

In another shop we saw a ¼-inch drill being run 450 revolutions per minute, or about 90 feet cutting speed and a feed of 0.037 inch per revolution. This was used dry on a steel casting, and although the friction was great enough to install a new high-power machine, the drill point apparently had not suffered in the least. When the feed was reduced to 0.02 inch per revolution, it was driven without difficulty and was used on many holes without regrinding.

	Speeds.		Feeds.		Back Gears.			
Size Drill.	Revolutions.	Cutting Speed.	Per Revolution.	Inches per Minute.	Ratio.	Position.	Actual Horsepower.	Kind of Drill.
1″ H'S.	313	82′	0.036″	11.27	1.71	top	5.22	Cleveland flat twisted.
1″ H.S.	450	118′	0.036″	16.2	1.71	top	5.60	Cleveland flat twisted.
1″ H.S.	575	150′	0.049″	28.1	1.71	top	11.60	Cleveland flat twisted.
1″ H.S.	575	150′	0.026″	14.9	1.71	top	3.13	Cleveland milled twist.
1″ H.S.	575	150′	0.049″	28.1	1.71	top	9.42	Cleveland milled twist.

DRILLING TEST IN CAST IRON 2″ THICK.

An Interesting Test

An interesting test made by the American Tool Works Company, Cincinnati, Ohio, is shown in the accompanying table. This was made to compare the flat twisted and the milled drill made by the Cleveland Twist Drill Company, the test being made for them. These figures are decidedly interesting, the first three seeming to indicate that the power required varies almost directly with the inches drilled per minute at the speeds and feeds shown. It would be interesting to see these worked out to compare the different feeds at a constant speed, as in the test of the milled drill. In this case with the same speed and obtaining the increase feed in inches per minute, by doubling the feed, the power is increased three times. It is also interesting to note that the power required for the milled drill is considerably less than for the twisted drill in these tests.

Those who have looked into the matter carefully seem to feel that this may be due to two different causes. The angle at which the cutting lip enters the work is not usually as favorable as with the twisted drill as in the other case, and there is also an idea that the tendency to untwist may cause binding in the hole being drilled. On the other hand, the tests on the Baush machine seemed to show that the twisted drill cleared itself better and was less liable to burn at high speed than the milled drill. As the normal bearing surface against the sides of the wall is approximately the same in both instances, it may be quite possible that the chips do not come out of the hole as readily with a milled drill, owing to the smaller chipped space and wedges between the relieved portion of the land and the side of the hole.

There is still much to be learned in this respect, and the many tests made by H. M. Norris, some of which have already appeared, will, we believe, throw considerable light on this important subject.

Moving a Brick Machine Shop

By John E. Allen

An unusual undertaking is nearing completion in the city of Fitchburg, Mass. The brick factory of the C. H. Brown Engine Company has lately been moved a distance of 150 feet.

The work was commenced about the middle of January and has progressed as rapidly as weather permitted. First the blacksmith shop, a brick building 35 by 50 feet, was moved about 50 feet, turned one-fourth way around and raised eight feet to its new location. Next a boiler and engine room was constructed and the old engine and boilers were set up in the new building. Then the brick chimney was moved 150 feet to the rear of the boiler house. This stack was 85 feet high and weighed about 160 tons. When in place it was jacked up and seven additional feet of brickwork were put under it.

The contractors then proceeded on the main building. This was a brick structure 166 feet long, 50 feet wide and three stories high, and weighed about 400 tons including the machinery. The machinery in the building consisted of about 75 machine tools, including a lathe and a planer each weighing 30 tons.

Moving a brick building of this size is uncommon, and is the first job of its kind in this vicinity. To facilitate the work, the building was divided into two parts by cutting across the center. Each part was then moved separately, first eastward 60 feet, then northward 150 feet. When the first section was in place, this operation was repeated on the second and the two were brought together and connected as before. When in the final position, the building was raised and a 12-foot basement built of granite, placed beneath the original structure.

The staging to carry the rollers was composed of several thousand six-foot railroad ties. It required 500 eight-inch by four-foot rollers and 300 jack screws in the operation. Two sets of 4-sheave blocks using 1¼-inch manila rope were employed. The motive power consisted of seven horses harnessed to regulation windlasses.

What makes the feat more remarkable is the fact that the Brown Engine Company did not lose a single working day in spite of the moving. Even while the building was divided in two, the work continued as usual, the open ends being boarded over to keep out the weather.

During this time, as it was, of course, impossible to furnish power from their own engine, the factory was run by three electric motors developing 75 horsepower, taking current from the local electric power company.

At the time of writing three months have been spent on the work and it is expected to be completed in about five weeks. Two accompanying halftones show the stack and the two sections of the shop *en route*.

Fig. 1 Moving the Machine Shop and Stack of C. H. Brown Company

Fig. 2

An Indexing Milling Machine

By C. Nosrac

An automatic machine equipped with an indexing fixture which is used for cutting accurate notches in light castings.

How the work is held and operated upon.

The machine illustrated herewith was designed for the purpose of automatically milling the slots in the segment-shaped castings shown in Fig. 1. These pieces are of cast iron and have a varying number of slots cut in the circumferential portion, the number of slots being anywhere from 4 to 11, and they are used in the construction of a well known mechanical product.

It will be noticed that the casting is of a rather delicate construction, and the section of metal left between the cuts, is of small volume, which necessitates the cutting being carefully done, while the usage to which the parts are put after finishing is such that it demands accuracy and smoothness in the slots. It will also be noticed that these slots do not run radially to the center of the casting, but tangent to a circle described about its center.

The casting comes to this machine with its central boss reamed and faced to proper size, and with the curved portion faced on the top, bottom and ends, and also having a narrow groove milled in the circumference of the piece. The machine then cuts notches to a predetermined number, and automatically stops, completing a segment of 11 notches in 2½ minutes, and smaller sizes in a time directly proportional to the number of

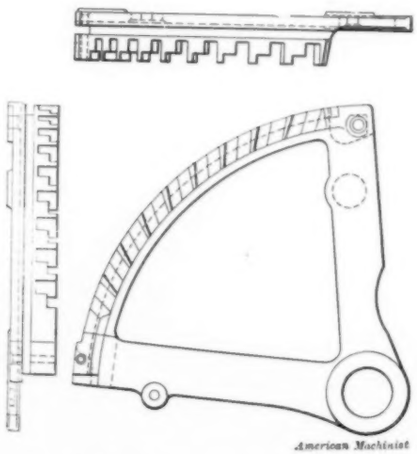


FIG. 1. THE SEGMENT TO BE SLOTTED

notches. It only requires ten to fifteen seconds to reload the machine.

In designing this machine it was decided to make use of the base and the castings of several old pinion cutters which had worn themselves out in service, and for this reason the resulting machine did not have as symmetrical and graceful an appearance as would have been secured had the entire device been designed anew.

A sketch of the complete machine is shown in Fig. 2 with a casting in position ready to start. The body of the machine consists of a box-shaped iron casting mounted on a suitable pedestal, and embodying two heavy rectangular-shaped posts, between which swings an adjustable head which carries the cutter arbor, and which is securely locked in any position by means of a through bolt and nut. This swinging head is elevated or depressed by means of a worm mounted on a short shaft, turned by means of a handwheel, and which engages wormwheel teeth cut on a projecting segment of the swinging head.

The head swings on a long stud securely fastened in the rectangular posts, and on the rear end of this stud revolves a spur gear which meshes with a mate on the cutter arbor. This driving gear, together with a sprocket which drives the cam operating worm shaft, is secured to a flange pulley, which is the source of power for the entire machine.

The base of the machine is provided with dovetail ways, in which slides the reciprocating table of the machine, and upon this table is mounted the indexing turn-table fixture, shown in Fig. 2. Reciprocating motion is imparted to the table and fixture by means of a large box cam horizontally mounted on a vertical stud within the hollow base of the machine, through a stud and roller, which project below the sliding table.

The cam has a bronze worm wheel attached to its under side, which is engaged by a steel worm mounted on a horizontal shaft, which runs from front to rear of the machine, and which is supported in a vertically pivoted bearing at its rear end, so the worm can be swung in and out of mesh with the worm wheel by means of the projecting handle shown in front of the base of the machine in Fig. 2. This shaft also carries a sprocket wheel on its rear end, which is driven by a block chain from the sprocket wheel on the driving pulley. The shaft is normally held by means of a helical spring, in such a position that the worm is out of mesh with the cam worm wheel, but when thrown into mesh by means of the projecting handle, is locked there by the action of a latch lever, which is plainly shown in Fig. 2, as are also the tripping lever and links.

Proceeding now to the fixture proper, it comprises a casting faced off on the top and bottom, and securely attached by heavy screws and dowels, and with tongue and groove to the sliding table. A vertical post cast integral with the in-

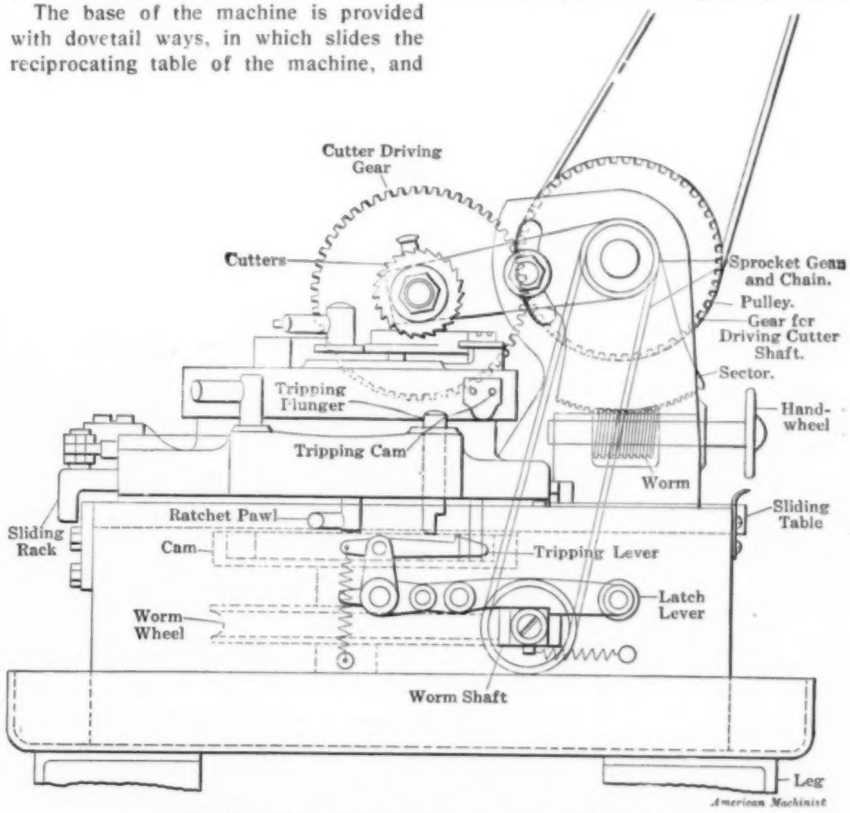


FIG. 2. AUTOMATIC INDEXING MILLING MACHINE

dexing turn table on its under side, and revolving in the fixture base in a tapered bearing, serves as a central bearing for the index mechanism, which operates the fixture.

A drawing of the fixture is shown in Fig. 3. *A* is the fixture base; *B*, the turn table; *C*, the indexing plate which is screwed and doweled to the table; *D* is the index pawl arm to which is screwed and doweled the small spur gear *E*, the two parts being able to rock together about the central shaft on the turn table, and being operated by means of a rack *F*, which runs in grooves in the fixture base, and which has downwardly projecting ends which come in contact with a block *G* at one end of the table stroke, and a pin *H* at the other end of the stroke. The block and pin are fastened to the base of the machine.

This interference causes the rack to slide back and forth and impart an oscillating motion to the gear *E* and the index plate arm *D*, which carries a pawl *J* at its outer extremity that engages the teeth on the indexing plate *C*, and indexes the table around one tooth at a time. This pawl has a small handle attached to its hub by means of which it can be turned out of action, so that the turn table may be swung back to zero.

The index plate *C* has two sets of notches or teeth in its periphery, one set for the locking plunger *K* to engage with, and one for the operation of the index plate. The locking plunger *K* slides in hardened-steel bushings in the fixture base and serves to lock the turn table securely during the cutting of each slot in the casting, and to release it in time for proper indexing to take place. This plunger is pressed inwardly by a strong helical spring, and is released by the action of a bell-crank lever *L* pivoted on a projection of the fixture base, and carrying a cam roller at the extremity of its short arm, which strikes a block cam *M* fastened to the machine base. This causes the plunger to unlock the index plate.

On top of the turn table is a tool-steel centering stud *N* over which the center of the casting to be machined just fits. This stud has a half-thread on its upper portion, and a half-threaded nut *P* with a handle on it serves to quickly release the central portion of the segment casting which is being machined. There is also a tool-steel block *R* having a projecting lip which will slide into the circular groove in the casting and support it rigidly.

The casting is slipped over the center stud, then swung around until its outer portion has passed over the lip on the tool-steel block *R*, and until its outer end rests against the locating block *W*, in which position it is clamped by means of the half-threaded nut and also by the ingenious little clamp shown in Fig. 4.

Owing to the fixture passing under the cutter arbor, this clamp has to be low enough, so as not to strike the arbor or cutter, and must also tip down, so that its clamp hook end will permit removing the casting by rotating it far enough to clear the supporting block *R*. This clamp is operated by a nurled nut *S* which pulls up the wedge screw *T* through an inclined opening in the clamp hook *U* and the guide block *V*, thus throwing the clamp over by the wedge action and securely holding the segment against the locating block *W* by catching on the arm of the casting. The clamp hook is pressed outward by means of a helical spring in a recess behind it, when the nurled nut is loosened and the wedge screw depressed.

It will be noticed that the clamp-hook guide block and nurled nut all rock to-

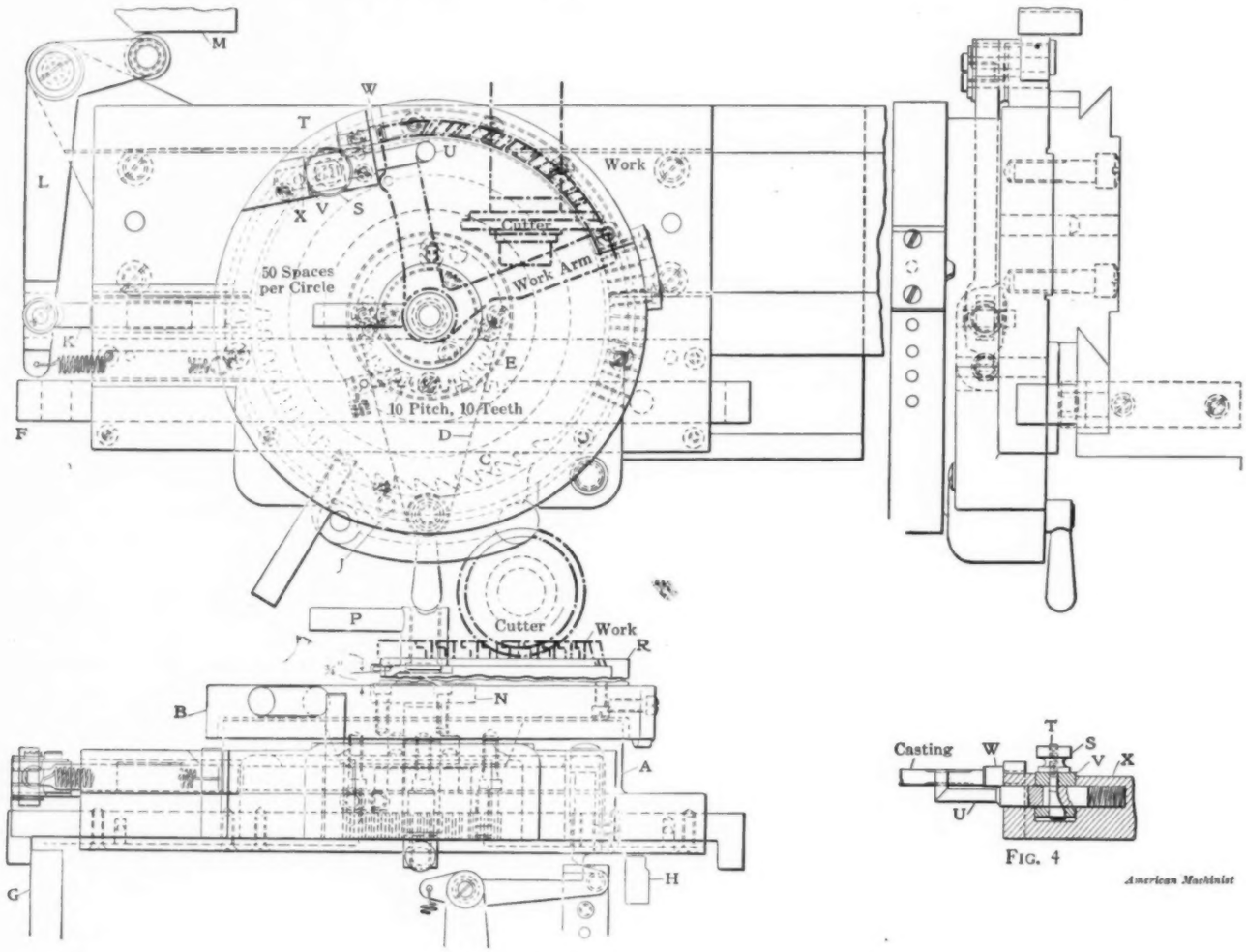


FIG. 4

American Machinist

FIG. 3. THE INDEXING FIXTURE

gether between the bosses on the block *X* and can be tilted 90 degrees, so that the segment arm can be passed over the end of the clamp hook when removing the casting from the fixture.

The throwout mechanism for stopping the machine after cutting a predetermined number of slots is extremely simple and consists of a tripping plunger cam, which may be moved around the edge of the turn table, into such position as to cause the machine to cut the required number of slots. As the turn table rotates to the position for cutting the last slot, the cam rides over and depresses a plunger, which slides vertically in hardened-steel bushings in the right-hand front portion of the fixture base. This plunger is normally pressed upward by means of a helical spring, but when held down by the action of the plunger cam, its lower extremity catches the tripping lever, which lifts the latch lever and lets the worm shaft throw the worm out of mesh, thus stopping the machine. The pawl *J* is then disengaged by means of its handle and the turn table swung back to zero position, where the fixture is reloaded and the worm thrown into mesh for starting again.

This machine has proved very efficient, one operator readily handling four machines which have a combined capacity of 850 of the 11-slot segments per day.

Shop Organization Problems

By Con Wise

Comments on the utility of an inspection department, depreciation of equipment, and an idea in planning and how to meet it.

We have been trying to decide which is the best business policy—to have an inspection department or not. Some readers will doubtless say this is as absurd a question as to ask whether we had best commit suicide or not, only they will not agree as to whether the suicide consists in having the department or not having it.

In looking over the shops that have such departments I have been struck with the idea that an inspector is a side issue with piece-work and premium plans of doing work. In these shops work is rushed and jammed and crowded to get it into the inspector's hands. All pride in the reputation of the shop is thrown to the winds. It is all a matter of getting something up to the inspector. If it were the aim of the men to get it safely past the inspector that would not be so bad, but these men are like a parcel of school boys doing examples and rushing up to the teacher to see if they are right before they even look them over to see how absurd their answers are. A man will put through a lot of shafts that he is morally certain are not finished as he would want them done and crow over it for a week if the inspector fails to notice the trouble. They rush work along with the piece rate or premium before them and then put the whole responsibility up to the inspector.

A Gang Boss with a New Mission

We are coming to the belief that the premium plan is all right but that we must cut the shop up into small gangs and put a boss on straight salary over each gang. These bosses would watch the work as it is made, not as inspectors but as friendly employers, anxious for the best results, for these men will be made responsible for the complaints which come from the output from their floors. In this way we will get two groups of men, one to get out work and lots of it, the other not to see whether it is right or not after it is done, but to see that it is done right at all stages. The most serious part of this matter is the question of what to pay these gang bosses. We are taking away from them the most arduous of the tasks of the old foremen, keeping the men working, and instead give them the comparatively easy and pleasant task of keeping them going in the right way. It seems as if they ought to work for less money. At the same time it takes as much ability as ever, they simply do not have to exercise their ability in one certain direction. Possibly we can compromise by having each man handle a larger gang. We certainly must give the foreman more pay than any of his help make or we won't be able to get foremen at all.

Depreciation

There is another thing about shop economies that bothers me and that is this matter of depreciation. I want to have a valuation on the whole plant by disinterested parties each year. They tell me that this is impossible, because if we change appraisers each year as I want to, some years the valuation will double what it was the year before instead of showing a depreciation. When they talk about a 10 per cent. a year allowance for depreciation and I see one engine lathe that has been used carefully on light work and another that has been abused on heavy work, that cost the same, I fail to see the logic of taking off the same depreciation. Then again some years the plant is worth more than it was before.

The Sinking Fund Proposition and Several Ways of Looking at It

Now what I am interested in is profits, cash profits. But they tell me that I ought not to draw out all the apparent profit because the plant needs replacement after 10 or 20 years, and there should be a fund something like a sinking fund to take care of it. That is just the way I want to handle it, like a sinking fund. I don't believe that there is any such thing as a depreciation by rule or one that can be accurately predicted. Moreover, in just the years when the market value of the plant is the least is the time when there is the least money to be spared to put into replacements. The profit from the business of a manufacturing concern for a year is the difference between current expenses and current income plus or minus the difference between the material on hand at the beginning and end of the year, whether raw, finished or in process. The investment may be growing less valuable, in which case money should be saved out of the profits before dividends are paid. How much should be saved depends on how greedy the stockholders are. If there is more profit in the business than they can get in any other direction in which they are placing money, then it would be better for them to put all their profits back into the business and they will likely do it.

Another Viewpoint

If they can invest their profits in something else that pays the same rate, then it makes no difference whether they go on year after year without allowing for depreciation or setting aside a fund, and stand an assessment occasionally to renew the plant, or whether they keep a depreciation fund.

Of course, if you are promoting the business and have a little common stock and you can get the holders of preferred stock to put part of their profits back into the business it improves your chances of getting dividends on the common at their expense.

The most absolutely certain thing is that no one knows what the value of a manufacturing plant is. The courts define value as a price which can be agreed on by a willing buyer and a willing seller, but they say nothing about the degree of willingness to let the other fellow have the long end of the bargain.

Patternmaking for Bulldozers—II*

The procedure in making patterns for Ajax high speed bulldozer. Selection of proper metal, shrinkage, allowance, molding methods, patternmaker's lay-out, etc. A large casting on which representative methods, that may be generally applied, are involved.

*Continued from last issue.

The box in which the cores are made for the core print that is moved 3 inches off of the center line makes the cores *A*, *B* and *C* in Fig. 9; the stop-off piece marked core *C* being required to make that core. The box is arranged for core *A*; the half-round core print for the main-shaft bearing runs the full length across the box. In addition, but not shown, there are 4 small change pieces that form the finish and the supporting lugs for the cap for the center bearings shown at *X*, Fig. 2.

In arranging this box for core *B* everything is taken out and the piece for the center bearing, marked core *B*, put in and located by dowel pins in the bottom board. The bearing part of this is withdrawn from the sand before rolling over; the supporting rib being drawn afterward on a line following the curve of the rib. Core *C* needs no explanation more than has already been given; with the bearing omitted, it is the reverse of core *A*.

Core *H*, Fig. 9, is self-explanatory. It contains the metal thickness for the shelf bracket and a section of the flange.

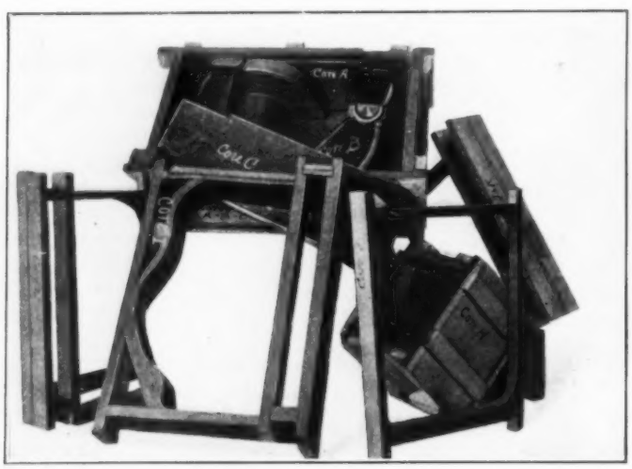
Lightening Cores

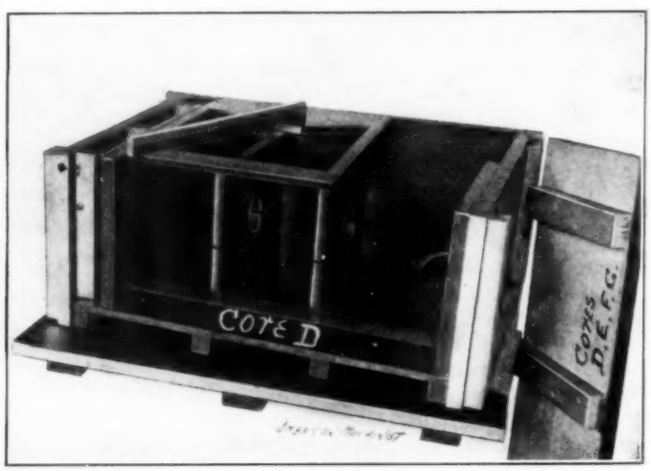
Cores *I*, *J*, *K* and *L* are lightening cores for the outside girders of the casting. The frame shown on top of these is loose, and for reversing (right or left hand) is placed on the opposite side of the box. In order to properly locate these, a print is formed in the adjoining cores. On the same side, chaplets are rammed up with the core, on a line shown on the box. These protrude the correct metal thickness and when the core is placed they fall against the other cores by their own weight.

Cores for Shaft End of Pattern

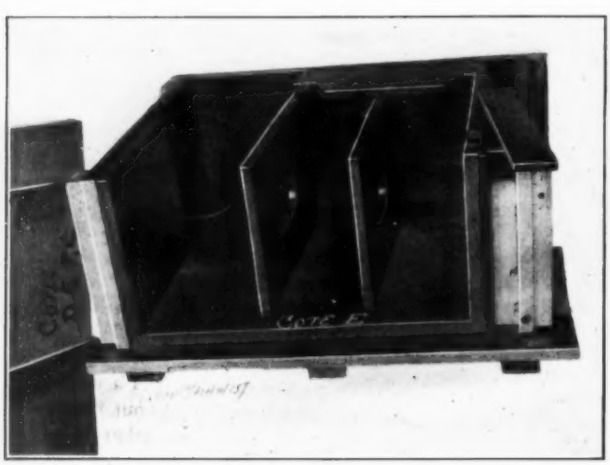
Cores *D*, *E*, *F* and *G* are made from the same box and are shown in Figs. 10, 11, 12 and 13; the front side of each box being removed for photographing. This box does not seem complicated, but the core maker held a different opinion when he got all the changes at once and had to make four different cores in the one box. Some of the loose parts are used two or more times, but all were carefully stamped with the symbol of the core for which they were used and this simplified matters so there was little trouble.

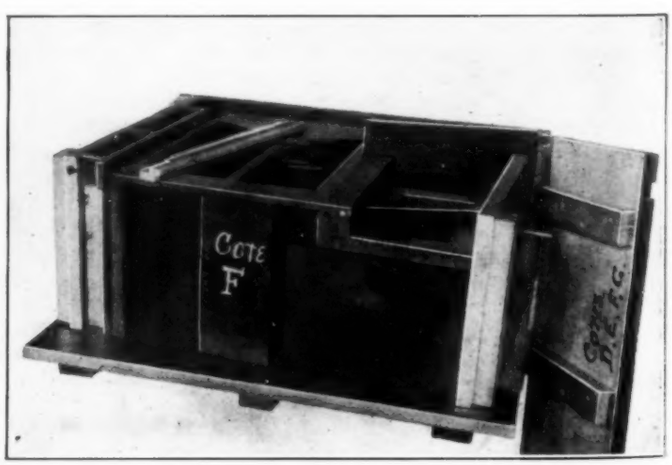
The illustrations leave little to be said by way of description but a few words of explanation may be necessary. In the first place it will be noted that the





Figs. 9 and 10. Core Boxes for Shaft Bearing End of Pattern





Figs. 11 and 12. Core Boxes as Set Up for Cores E and F

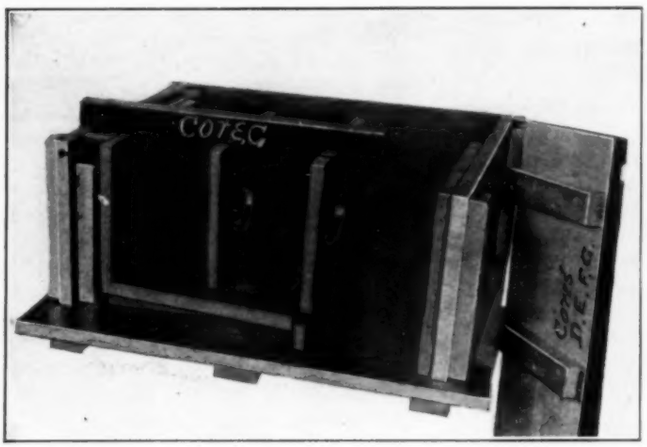


FIG. 13. CORE BOX AS SET UP FOR CORE G

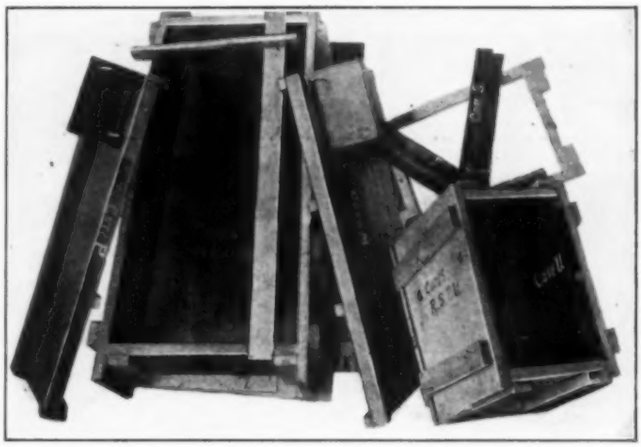


FIG. 14. CORE BOXES FOR CENTRAL PORTION OF PATTERN

bottom board for the box for core *D*, is much wider than the frame, especially at one end. This is undesirable for heavy cores, as rough handling in heavy chains, is apt to break it. In this case, however, it was unavoidable as cores *D*, *F* and *G* are made with the frame of the box the same side up, while for core *E* the frame is turned over.

Cores *D* and *G* have core prints for cores *I*. In *D* it rests on the bottom board, as shown, but in core *G* it must be placed even with the top of the box. In arranging core *G* for photographing an error was made in placing the core print for the main-shaft bearing; the short print used with *E* and *F* being shown, whereas the same core print used in core *D*, which reaches the top edge of box was used for this core.

SWEEPS FOR CORES

Cores *D*, *E*, *F* and *G* should be viewed in connection with the plan view, Fig. 1, so that the arrangement may be readily understood. Core *D*, Fig. 10, shows clearly the arrangement for sweeping out the half thickness of rib at the top of the box. This is left open for convenience in ramming the core. Core *F*, Fig. 12, is practically two cores in one box, the part marked F_1 being detached in the making. In this box there are four different sweeps used: The first one, not shown, rests on the top edge of the frame of the box and forms the first level or total hight of core required; No. 2 is the same sweep that is used with cores *D*, *E* and *F*; sweep 3 forms an offset in the core that matches core *G*, and sweep 4 is for sweeping out the metal thickness of the connecting rib, which was built open for convenience in ramming.

CORES FOR CENTER PORTION OF PATTERN

In Fig. 14 we have two core boxes, grouped with their respective change pieces; cores *M*, *N*, *O* and *P* are made in one box and are simple, as both sides of the pattern are symmetrical. For cores *M* and *P* the bottom board was used, with the frame of the box resting on it. The false bottom, to which were attached the shelf bracket, part of a rib, and the core print for cores *J* and *K*, was dropped in place. The core was then rammed up and rolled over to remove the box. The metal thickness for the top rib was swept out, as shown. The bar running lengthwise of box, to carry the sweep, has on its underside the reinforcement, or *T* head of the rib.

In making cores *N* and *O* the bottom board is discarded and the core made directly on the drying plate to avoid roiling over. The same arrangement for sweeping is used. These cores are made the full depth of the box and the reverse cores are made with the box, the other side up.

The core box for cores *R*, *S*, *T* and *U* is shown arranged for core *U*; it having the stop-off piece, for width of core, in place. Doweled at the bottom is a piece for the reinforcement of the metal above the T head-bolt core, and also a tail-core print for the small round core for the treadle rod. On the opposite side of the box is the core print for core *L* and directly underneath this a shorter print for the round core for the treadle rod. to reverse for core *R*, these prints change places; the dowel holes being bored interchangeable. The core print for core *L* and the piece in the bottom of the box also change to the opposite side. In changing for cores *S* and *T*, these pieces are all taken out; the box used full width, and it is made deeper by adding the frame shown above the box. All that goes in these two cores are the pieces marked *Core S* and *Core T*; one piece being used for each core.

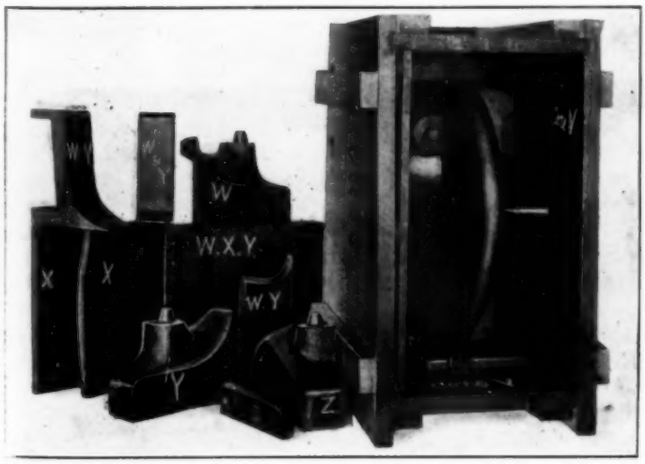


FIG. 15. CORES FOR CENTRAL PORTION OF PATTERN

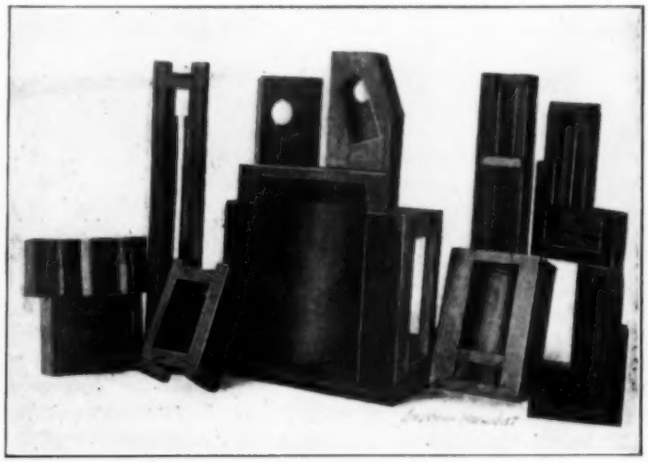


FIG. 16. ALL SMALL CORE BOXES IN A GROUP

Cores for Opposite End of Pattern

In Fig. 15 is shown the box and change pieces for cores *V*, *W*, *X*, *Y* and *Z*. As shown, it is set up for core *V*. In changing over for the other cores, the pieces shown to the left of the box are used for the cores that are marked on them. Core *Z* is simply the opposite hand to that shown. The only pieces in the box that are not used, are the opposite pieces to those marked *Z*. These take their place and the rest of the pieces are transposed.

The stop-off piece is used to give the taper of the core print to one side of the box for each of the outside cores. If it were not for this taper all the boxes could have been made the same width and the print divided into five equal parts. In spacing off these cores an allowance on each core of 5/16 inch was made for the swelling of the core and placing it in the mold. How this figured out will be shown in the article on molding the frames, that is to follow. Core *X* being the center core, only the three pieces marked *X* are used, while for cores *W* and *Y* most of the pieces in the box are used, along with those marked *W* and *Y*. The whole arrangement can be seen in the plan view, Fig. 1.

Small Cores

In Fig. 16 is shown a group of the small core boxes. These are all simple and require no description, each finding its own place, and fitting in some place in the foregoing illustrations.

After a careful checking up and finishing of the several parts, each being marked for its proper location as clearly as possible to avoid confusion and possible error in the foundry, the pattern work is completed and we are ready to turn it over to the molder. A description of his handling of it in the foundry for making the casting will appear in the a later issue.

Gear vs. Cone Driven Machines*

By Wm. Lodge and R. K. LeBlond

The advantages of each as well as their weak points. First cost, maintenance, power delivered and power lost and comparison of output.

*Condensed from papers read before convention of National Machine Tool Builders Association.

The cone drive was made originally to give a variety of speeds and because of the variety of speeds needed a long length was required and necessarily the width of the belt was cut down because to make a cone pulley with a belt of sufficient width to give great power would not only be very difficult to shift from one speed to another, but would increase the length of the lathe head to undue proportions. This always limited the amount of power that could be obtained through the belt, particularly when driving without the gears.

The cutting of metal at high rates of speed has called for a new design, increasing the power anywhere from two to five times, hence the need for the gear drive and the single belt. This does not by any means eliminate the cone pulley because of the fact that a great deal of work is of a very light character where the cone pulley can be used to good advantage, but it does bring us face to face with the problem of how we ought best to meet the condition brought about by the change in architecture of machine-shop buildings.

The modern machine-shop building has a very much higher ceiling, which increases the difficulty of manipulating the belt from one step to another of the cone pulley.

It might be well to call the attention of the members of our association to the necessity of providing countershafts that are driven by cone pulley to be either a part of the lathe or else provide suitable drop brackets from the ceiling that will permit the length of the belt to operate about the same as in the old days when ceilings were ten and twelve feet high. A suggestion at this point may be in order in looking toward the belt having a permanent joint or being made what is known as an endless belt and then an easy method applied to the countershaft of raising the journal bearings sufficiently to keep the belt taut.

I have noticed in my experience that the tendency on the part of the seller of our line of product is to talk high power and to persuade the customer into buying more power than is needed for the work in hand. I call to mind some time ago being asked to give an opinion as to one of these high-power machines and saying to the party who was making it (the size, by the way, being a lathe of 18-inch swing and the power provided permitting a cut 1 inch in depth with a good strong feed). "Suppose you were buying lathes for your own shop to do your own work, and were equipping a new shop, how many of this particular type of lathe would you put into commission?" and he answered very promptly, "A very few." This shows very clearly that a large percentage of the lathes used do not need to be geared for tremendous power and there is room for lathes of a much lighter character for the work of that type.

The object of this paper is to direct the attention of the membership toward making the very best article for performing the work wanted and toward securing all the trade possible, solely because we are furnishing the best article for the work in hand, no matter of what nature.

Cone Drive

Theoretically, the geared-head drive has the most advantages, and the present development is along the geared-head lines, but practically and commercially, the cone-driven machine is more than holding its own, and as we gather our costly experience from miscellaneous experiments on gear-driven machines, we discover that the cone drive is still to be an important factor in machine-tool design.

All the advantages that can possibly be claimed for the geared-head machine can be better obtained with a variable-speed motor and comparatively few mechanical changes. This is owing to the fact that the electrical changes can be obtained with a much smaller friction loss—that is, more efficiently; that the change increments are much closer; that the speeds can always be obtained while the machine is in motion. In other words, the motor drive is the ideal geared machine.

The greatest defects in the all-geared machines are lack of efficiency, expense of maintenance, and the increased first cost. This holds true regardless of the fact of the changes being made in one unit or distributed in two and one placed on the ceiling.

In extreme cases with the geared machine, but 40 per cent. of the power applied to the machine is delivered to the cutting tool or spindle. In the case of feeds, as shown by Mr. DeLeeuw's experiments, the friction on the shafts and gears has reduced this down to as low as 2 per cent., and under the very best conditions, 20 per cent. of the power applied.

In going through a large machine-tool shop with the superintendent, we stopped at their single-pulley drive 16-inch lathe. While standing there, an office boy brought a copy of an order for one of these machines on which the purchaser wished to apply a one-horsepower motor. The superintendent immediately said this

was impossible, saying it took more than one horsepower to turn the machine over empty. This was a friction construction. At the same time, under the old belting conditions, tests made on these same lathes by different authorities, resulted in establishing the power consumption of ½ horsepower under actual working conditions.

In comparison with this, take the old-fashioned cone. On the direct speeds, or open-belt speeds, we could obtain an efficiency as high as 95 per cent., and in the extreme cases of transmitting power through the back gear, it very seldom went lower than 76 per cent. This difference in efficiency has to be taken up by the machine itself. In other words, it is a destructive element. It means friction on the journals, friction on the gears, heat generated to be taken up by the body of the machine, and wear in general, from all of which the user obtains no benefit and which goes into the maintenance charge.

I think you will find, if you investigate carefully your overhead charges, the increased cost of the geared-head machines, added to the increased maintenance cost, added to your increased power cost, will more than outweigh all the advantages claimed by exponents of the all-geared machines.

The advocates of the geared machines always harp upon the advantages of instantaneous speed changes. Now, as a matter of fact, one of the best known makers in this country places a plate on his machine on which is stated positively that the machine must be stopped when changing speeds. Another has to throw in and out back gears when making the change of speeds, which necessitates the stopping of the machine. The only instantaneously changed machines are the friction changes.

Now for the "old reliable" cone drive. I do not mean the old-fashioned cone which was small in diameter and narrow face. I mean the double-friction, back-geared cone, which can be made of large diameter and proper face, the two ratios of back gearing enabling a cone to be designed so the old small step is entirely eliminated. With this type of drive you can deliver to your spindle twice the power you can with the same size pulley on a geared drive.

Objections to belt shifting can be easily eliminated on the cone-driven machine with a belt-shifting device, and is eliminated without this device by the operator, where the belts are of moderate width and length. The operator does not have to stop the machine to make the changes, and practically performs an instantaneous speed change. The ideal drive today is large cone diameters and not overly wide belts.

This has also been exemplified in feeds. For instance, take grinding machines. Brown & Sharpe and Norton are both using cone belts on their feed changes, after both have experimented and used different forms of gear changes.

Now about the canard of the belt pull on the spindle. With the geared-head machines, of course there is no belt pull on the spindle, but there is the gear pressure, which in slow speeds, is multiplied a great many times and is considerably more than the belt pull. Further than this, on a cone-driven machine, the belt pull is not a detriment, but a possible advantage. It simply serves to counterbalance the weight of the moving parts, namely, the cone and spindle.

In my machine-tool experience, I have never heard of a lathe spindle wearing upwards. We know positively from our experience with second-hand lathes, that the spindles are invariably lower than the tailstocks, so this would demonstrate thoroughly that the wear of the spindle is downward in spite of the belt pull.

It is an indisputable fact that in 99 machines out of every 100, the cone drive is capable of furnishing much greater power than is required for the machine as operated; that is, the machines of today are not worked to 50 per cent. of their pulling capacity. If they were it would be a mighty bad thing for the machine-tool builders. The excessive pulling power in 99 cases out of 100 is not a legitimate requirement, as the purpose of machining today is not to make chips, but to do accurate work.

Keys for Large Gears

By Chas. W. Logue

For heavy gears the ordinary key will not answer: it is often necessary to put in two keys diametrically opposite, and for extremely heavy work, what is known as the "Kennedy" key, Fig. 1. This is the only key that will answer the requirements of rolling-mill work. At the armor-plate mill of the Carnegie plant this type of key is used in the 22-inch shaft of rolls that reverse on an average of 20 times per minute. No other key would stand up to this work. These keys are made approximately one-quarter of the shaft diameter, and located in the gear so that two corners of the keys intersect the bore. It is not necessary for the bottoms of the keys to be on a vertical line. The keys are made to a taper of ⅛ inch per foot on the top for a driving fit, the sides being just a neat fit. The shaft is first bored for a press fit, then rebored about 1/64 of the shaft diameter off the center, the keyways are cut in the eccentric side. That portion of the bore opposite the keys remains as originally bored to within one-tenth of the shaft diameter below the center line.

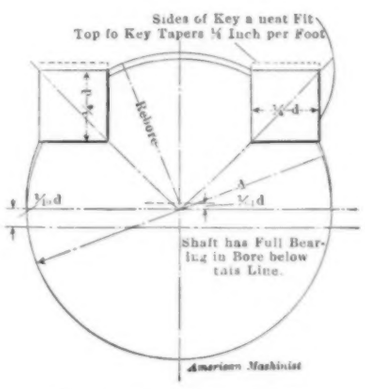

Sides of Key a neat Fit
Top to Key Tapers ¼ Inch per Foot
Relief
⅛ d
⅛ d
⅛ d
Shaft has Full Bearing in Bore below this Line.
American Machinist

FIG. 1. THE KENNEDY KEY

The "Kennedy" key is especially desirable where it is necessary to move the gear for any considerable distance on the shaft before securing.

Where a sliding gear is used for heavy work, three keys, having radial sides as illustrated by Fig. 2, are generally employed. An example of this i the gear drive for vertical rolls. This style of key has a distinct advantage over the four-key type with parallel sides as illustrated by Fig. 3.

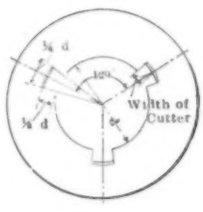


FIG. 2. KEYWAYS FOR HEAVY SLIDING GEAR

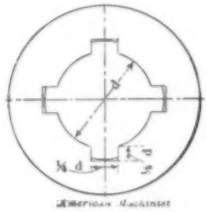


FIG. 3. FOUR KEYED SLIDING GEAR

The following is extracted from a paper read before the Birmingham Association of Mechanical Engineers:

The use of vanadium in tool steels may almost be referred to as "homeopathic metallurgy," for it appears to be almost a question of not how much to use, but rather how small a quantity, which may be instanced from the fact that high-speed steel containing only 0.25 per cent. vanadium possesses in some cases twice the cutting capacity of similar steel which does not contain vanadium.

Letters from Practical Men

Drill Jig For Ball Rods

Having a considerable number of ball-ended bars to drill through the center of their knobs, I devised the jig shown in the drawing, Fig. 1, to meet the case. The knobs vary in diameter from 2½ inches down to one inch and the length of the bars varies in a corresponding manner. The problem is not a very difficult one, but it is not always easy to hit on the best way of performing such an operation immediately, and maybe some of your readers will be meeting the same task before long and will be glad to have some of the brain twisting done for them.

The ball end of the bar is placed in a fixed inverted cone *A* and the other end is held in a similar though smaller inverted cone *B*, fixed in a block *C*, which slides on a screw *D*. The action of these two cones, when clamped, is to bring the axis of the bar to be operated on always into one position, whatever may be the size of the bar or its knob.

One of the novel points of the jig is the method of quickly applying pressure to this block so as to clamp the bar to be drilled firmly between the two inverted cones.

The block *C* is a sliding fit on the screw *D* and feathered to it so as to keep it upright. The lever *E*, hinged behind the block *C* to a collar and traveling with it, is formed into a part nut. When it is desired to apply locking pressure to the bar through the block *C*, the part nut on the lever *E* is brought into mesh with the screw and screwed up as though it were a simple nut, thus tightening and clamping it. To release the bar, the lever is eased off, swung out of the way and the block *C* slipped back.

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

The other difficulty to overcome is to make a movable drill bush to guide the drill that it may pass through a diameter of the knob of the work. This was done by means of the sliding bracket *F*, which is fastened on an inclined slide at 35¼ degrees. This angle will bring the drill guide bush to the right hight above the work when it reaches the central position of the ball of any size whatever. It only now remains to graduate this sliding block for each size of knob, and the jig is complete.

Some will be interested to learn how the angle of 35¼ degrees is obtained, although it is only a simple geometrical problem solved by the aid of elementary trigonometry.

Draw two lines *A B*, *A C* at right angles to each other to represent the inverted cone. Within this angle and touching each side of it draw two circles of different size with centers *D* and *E* to represent the ball ends of the rods. From *D* and *E* draw radii at right angles to *A E*, cutting the circles at *F* and *G* respectively, and from *E* draw a radius at right angles to *A B*, cutting *A B* at *B*. Join *G* to *F* and produce it, when it will be found to pass through the point *A*. Then the angle *G A E* or Θ is the angle required.

Now the triangle *A B E* is a right-angled isosceles triangle and therefore, if *B E* (the radius of the circle *B G C*) be taken as unity, the side *A E* is equal to $\sqrt{2}$.

Now, in triangle *A G E*, the side *G E* equals 1 and *A E* equals $\sqrt{2}$.

$$\text{But } \tan.\ \Theta = \frac{G\,E}{A\,E} = \frac{1}{\sqrt{2}} = 0.707.$$

Therefore, $\Theta = 35$ degrees 16 minutes

London, England. B. W. GRANT.

Some Tendencies in the Patent Law

There seems to be a popular notion that a patent is a sort of contract agreement between the patentee and the Government. In consideration of the publication of the invention and the surrender of all rights in it after a certain period, the Government grants a monopoly in the invention during that period. It is

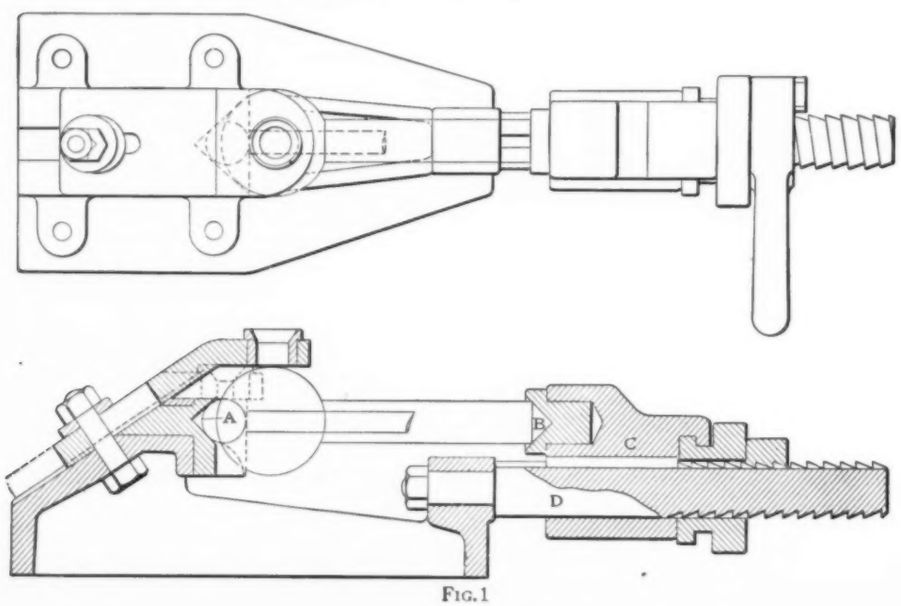


FIG. 1

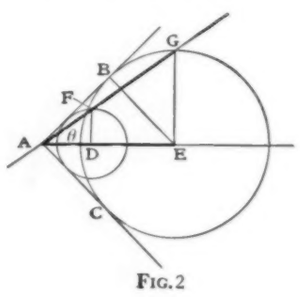
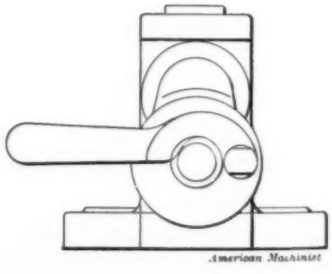


FIG. 2



DRILL JIG FOR BALL RODS

an exchange of commodities, a trade deal, a swap. The inventor gets protection that he would not otherwise have, and the public, through the Government, encourages invention and brings to light improvements that otherwise might not be made, or if made might lie in the dark, unused, for fear they would be lost or stolen.

That may all be so, and perhaps the scholars of the legal fraternity can prove it. But there is another way to look at it, that while it may be all wrong technically, at least appeals to common sense and the Anglo-Saxon love of justice. Also, it affords a basis for a possible and satisfactory solution of the difficulties and complications of the present state of affairs. At least, it is entirely practical and businesslike, and if it is not possible, so much the worse.

A patent is not a grant at all. That is to say, if it is, it shouldn't be. It is a formal confirmation and limitation of existing rights. In these enlightened days it is not too much to expect recognition of the value of intangible property, or of property rights in those values. Good will and trade names are business assets of enormous value, as no one will deny. They are built up by the expenditure of time, money, energy and brains. They are property just as much as buildings and land, tools and merchandise. The old common law had some difficulty with that fact, but the equity courts were willing to acknowledge that when values are created they become somebody's property, and ought to belong to whoever created them. Then a valuable invention ought to belong to the inventor. It is hard to conceive how the Government can grant to an inventor the thing that he invented or a property right in the product of his brains and industry. He is morally if not legally entitled to it anyway, patent or no patent. The least that equity can do is to protect him in his natural right to values that are most peculiarly his own, since he created them.

To present and defend that proposition, and to submit that it is the correct view toward which civilization is working and to which in the course of time the courts hopefully will attain, is the purpose of this paper.

The Coffee Mill Case

A long step in this direction was made in the famous coffee-mill case some five years ago. The defendant admitted that he had imitated the complaintant's device, and claimed a right to do so because the patent had expired. Observe that the decision rested, therefore, not on a patent, but on the complainant's inherent right to the intangible property that he had created. And the legal fraternity as well as the business world applauded the broad-minded judge who assured the protection of the court to the creator of values. It is one of a rapidly lengthening series of decisions that tend to look beyond the technicalities of specification and claim and to inquire what was done to add to the welfare of the public and the wealth of the nation, in order to protect genius, industry, enterprise and capital from depredation. A patent looms small on the edge of so comprehensive a view of the situation. A patent is a bit of evidence, material and relevant. It is gradually being relegated to its proper position. In determining ownership of intangible valuable property, the real question is, Who created those values? Then said creator, his heirs and assigns, is the owner.

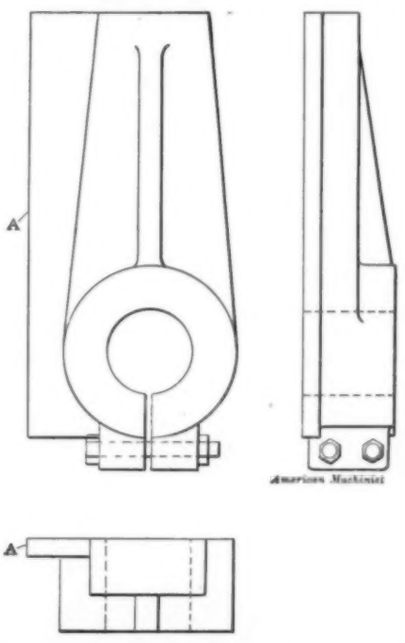
This does not imply that the patent will cease to exist, or that the Patent Office will have to close its doors. Perhaps it will undergo little or no change. But its functions and its product may be regarded in rather a different light, perhaps to the large advantage of the business world. It may be looked upon as a hall of records, where *ex parte* evidence may be presented, considered, rejected or formally acknowledged, and filed for use in case of need, and for public inspection. Then the venturer on industrial seas need no longer fear commercial pirates, nor depend for safety on the ability of his attorney to pilot him among the rocks and shoals of conflicting opinion, nice distinctions and endless technicalities.

"Make ye sure to each his own,
"That he reap where he hath sown."

Beloit, Wis. J. C. Howell.

Crank Dogs

On looking through some back numbers of the American Machinist, I noticed a sketch of a crank dog, similar to what is generally used in most engine shops. In our shop we made a slight addition to this design some time ago, and it was the absence of this that attracted my attention. The addition referred to consists of the flange *A*, which is added to both dogs, only on opposite sides. The advantage of this is, that it does away with all setting. Face *A* is machined to correspond with the width of the crank web. After the crank is roughed out on the body, the piece taken out of the throw, and the webs planed, it is placed on the lathe bed and the dogs are slipped on the ends. The bolts in the dogs are now tightened and the crank is ready for putting in centers.



Crank Dog

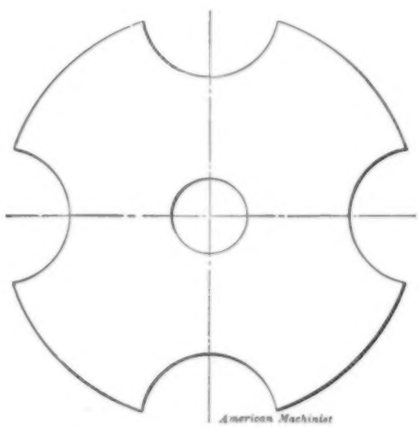
It will be seen that in addition to the time saved in setting, they insure the crank pin being parallel with the body of the shaft, an important point in its favor. After roughing out the crank-pin with heavy cuts, the setting of the dogs can be checked to see if they have moved, by putting a straight-edge across the two flanges *A* and placing a spirit level on the straight-edge. This will immediately show if the heavy cuts have disturbed the original setting.

M. A. Root.

Birmingham, England.

An Emery Wheel Kink

Here is another "grinding kink" for handling delicate work, or work which does not revolve, such as reamers, cutters, snap gages, etc.



"Air Cooled" Emery Wheel

It consists in cutting notches in the wheel as in the sketch. There may be 4, 6 or more according to the size of the wheel, and they are readily ground out with the edge of another wheel, using care to take out a like amount on each side in order to retain the balance.

This makes an "air cooled" wheel and will be found to work to perfection in places where it is next to impossible to do business with a whole wheel.

Althol, Mass. W. H. Sawtell.

Discussion of Previous Question

Punching Fiber

From time to time there have been articles in the AMERICAN MACHINIST on punching fiber. We punch ⅜-inch fiber in the following manner. The punch is a flat piece of brass fastened with flat-head machine screws to a cast-iron holder. The die is an ordinary "open" die, similar to those used for punching leather, such as shoe soles and heels, but without a handle. It is fastened to the bolster. The punch is larger than the die and is set so as to just touch the face of the die. The blanks are first sawed to shape, leaving a little all around for the die to trim off. We formerly milled the pieces, but since the die was made we have no use for the milling machine on this job.

Philadelphia, Penn. S. F. M.

Peculiar Break of an Elevator Worm Shaft

Relating to D. Lustenberger's "Peculiar Break of an Elevator Worm Shaft," on page 218, please find inclosed a sketch of a ball bearing which would amend the trouble of the shaft being cut as shown. Before making assumptions I should like to have the following information:

1. Had the ball races quite bright surfaces after the breakdown?
2. Were the surfaces of the balls intact at this time or had they to be renewed?
3. Has the washer which is being pressed against the bearing much clearance round the shaft and is it held central by the shaft, or has the face of the bearing a recess into which the circumference, or shoulder (as shown in the accompanying sketch) of the stationary washer fits so that friction between shaft and washer is prevented?
4. Are there any signs of the washer slipping on the face of the bearing?
5. Has there been any protection against dust?
6. What sort of oil was used for lubricating, how often has this been done and in which way? Have the balls had much or little oil?
7. Had the ball bearing been running cool?
8. How much clearance has the shaft in the bore of the worm?
9. Does the shaft show bright places, at the worm's seat, especially at the ends?
10. What is the maximum load on the ball bearing, number of revolutions, number of balls, their size and diameter of ball race?

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

There appeared in the AMERICAN MACHINIST, Volume 31, Part 1, page 720, an article "The Factor of Safety in Ball Bearings," by which the dimensions of ball bearings could be controlled according to the particulars of question 10.

To make the following assumptions as clear as possible, I beg to note that I make a distinction between the ball bearing and the bearing which supports the shaft as shown in the sketch.

It often occurs that by choosing a ball bearing the starting inertia of a machine, which may be many times the running resistance, is entirely neglected. This may be the case with the illustrated ball bearing. The machine can run all right for a time—perhaps for years—but the starting overload will gradually cause the ball races to wear. If this has reached a certain degree the stationary washer will soon have a strong tendency to turn.

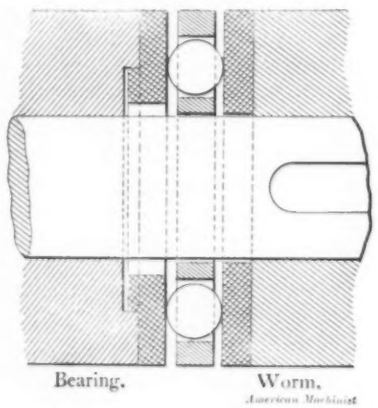


DIAGRAM OF BALL BEARING

It seems to me from the illustration as if the ball races on the washers are not grooved. This is the reason why I have shown them flat. In Mr. Lustenberger's case it seems as if the stationary washer was held central by the shaft only. Nothing could prevent this washer from turning occasionally and causing, when again coming to rest, friction on the shaft, as the worn spot will have a tendency to move in a direction away from the center. It will stick in this position until it is dragged along again which will have a similar effect to the feed on a cutting tool. Of course, the cutting of the shaft needs not to have been performed in a relatively short time, but can have had its beginning at the very moment the machine was put into working order.

As the sketch shows, the best remedy against such a cutting action is to keep the stationary washer central with a recess turned into the face of the bearing. With such a provision the stationary washer cannot move sideways and rub the shaft. CONRAD DEUTSCH.

Winterthur, Germany.

Adjusting Two Gas Engines to Drive One Shaft

The recent discussion on driving a line shaft by two motors reminds me of a similar case I had to deal with a short time ago; but instead of motors, I had gas engines.

Our shop was driven by a six-horsepower gas engine when first opened; but as our trade increased, more tools were added, then high-speed steel came into use, and we had to get a larger engine. This time we got one of 16 horsepower. This larger engine drove the same lineshaft, but from the other end of the shop. We still kept the smaller engine on its bed as a standby in case the other one broke down.

The speed of the lineshaft was increased when the new engine was fitted up, so that all the tools were running quicker. As trade increased, we found our old planer was getting too small, so we decided to get one of the modern kind to cut at 40 feet per minute and return at 90. When we fitted this up and got running, we found we did not have power enough to drive the planer, together with the other tools, when cutting a short stroke. As practically half our planing is small surfaces on large frames, we were stuck.

The new engine had only been in 12 months, and if we sold it and got a larger one, we stood to lose a lot of money. If we worked the planer slower we would lose money on every job. If we did these short stroke jobs at night it meant too much overtime for the man.

After thinking the matter over, we decided to drive one part of the shop by the small engine and the other part by the large engine. This would, of course, take more gas and need more attention to the engines, and would also necessi-

tate some alteration in the grouping of our tools; but after serious thought we decided this was the cheaper method.

HITCHING THE ENGINE TO THE SAME SHAFT

Before doing the alterations one of the men suggested that we should drive the lineshaft by both engines, and only use the small engine when the planer was working on the short stroke. This suggestion we decided to try and fitted a larger pulley on the engine so that it would drive the lineshaft pulleys at the right speed. We now put the belt on and started the engine with the belt running on the loose pulley on the lineshaft. When the engine had got up to speed, we shut off the gas and immediately shifted the belt to the tight pulley. The small engine was now being driven through the lineshaft by the larger engine. We adjusted the governor so that it just missed operating the gas valve every time, the usual load being on the other engine. Then the planer was started on the short stroke, and, of course, the larger engine slackened in speed a little so that the small engine took a portion of the load. On observation, we found this was firing three out of four cycles, and the large engine about seven out of eight.

We now had plenty of power without any expensive alterations, the only thing we had to get being the larger pulley for the engine. The small engine is only used when the planer is working on the short stroke and so no power is consumed when it is stopped, as we shift the belt onto the loose pulley on the lineshaft. This method of driving has given us no trouble so far, though we have used it four years, and though not strictly mechanical, it gets there all the same.

Lancashire, Eng. L. A. NOYES.

Concrete Floors

I have been hoping that more letters from the men on concrete floors would appear, but probably they are like my confrères, have that "all in" feeling and don't care to write. A. L. Putnam states the case correctly on the expense of shoes. Entropy's somewhat cynical comment in favor of rubber equipment has been tried, but does not equal the wood floor. I put a rubber outfit out of commission in six weeks.

Arch supports of the cushion variety and cushion shoes have been tried with decidedly beneficial effect; yet the discomfort of the cold floor is not overcome.

The loss to the owners of the plant is considerable from the impaired physical condition of employees on cold days, particularly in the morning, but in our shop, where drawing dies are in constant use, it is an added expense on production. The dust or grit put in motion by the hauling of stock boxes over the floors and the men in moving about plays the mischief with our drawing dies; it is especially noticeable with redraws.

It is not always convenient to redraw the same hour or the same day, which necessitates the work being thoroughly covered and protected from the dust, which is constantly on the move. Should a box of shells, which usually contains from 500 to 1000, be left over night uncovered, the expense will be increased from 5 to 20 per cent., plus the annoyance and irritation caused the operator from the necessity of removing the die to smooth its ruffled surface.

Ayer, Mass. B. O. ATKENS.

Comments on the Apprenticeship System Subject

I have read with much appreciation the article at page 780, describing the apprenticeship system of the Fore River Shipbuilding Company, and believe they have "hit the nail on the head" in more ways than one. Some of the points which seem especially commendable are: They select only those who have been grounded in the underlying principles of education by requiring the applicant to possess a training equivalent to that required to graduate from the grammar schools. They seem to appreciate that the boy is not theirs body and soul, that he is yet undeveloped and that his education *should not stop* at the grammar school and all his energies henceforth be concentrated upon how best he can earn a few more shekels by drilling a maximum number of holes or threading the largest possible amount of studs in a given time; on the contrary, they take four hours a week of his time (on pay), away from the grind to be devoted to the development of his mind.

The ratios of 8, 10, 12½ and 15 cents an hour for the first, second, third and fourth years, respectively, seem more just than the average. The boy who apprentices himself is usually required to help support the family, for if his parents are affluent they generally have other things in mind for their darling.

Again, the filling of minor positions in the drafting room from the apprenticeship school should not only act as an impetus to that school, but should actually benefit the drafting department. The general training on different machines instead of too much specializing in the first two years and the very practical method of teaching drawing are other points all worthy of mention and careful study by others.

One thing I would, however, like to point out is that all problems should be practical ones and I hope the example given of the shaft 10½ inches diameter, 10 feet 3 inches long, with a one-inch hole running through its entire length is not a fair sample. Why not have made the hole five inches in diameter, introduce a little talk upon the manufacture of such shafts, the object of the hole and its limiting sizes, then show that such a hole may very materially reduce the weight and yet *not* materially reduce the strength, etc. My idea is this: All problems should be made very practical from a constructive standpoint and wherever possible should be made interesting by a little talk, equally practical, which touches upon more advanced phases of the subject dealt with. Teach him to do well the work in hand, but always make the work point higher.

M. F. JACKSON.

Philadelphia, Penn.

Trade School Courses

Your excellent and valuable articles, "A Plea for the Untrained Worker," "Industrial Training by Apprenticeship," "Organization and Management of Trade Schools" and many others, all of which have bearing on the yet unsettled question of industrial education, should be called to the attention of all superintendents of schools of education through the country; for the reason that they are not likely to come in contact with the workers' side of the question as presented in the AMERICAN MACHINIST.

In a city near New York there is under construction an addition to a high school, which is to be devoted to industrial training, and the very questions raised and answered in the AMERICAN MACHINIST are under consideration.

The superintendent of schools makes the statement as above; that he is not brought in contact with the side of the question as discussed in your paper, and is thankful for all articles bearing on the subject which are cut from your journal and handed to him by an interested party.

Each subject taught in this course is carefully analyzed to find the best method by which to present and teach. Mechanical drawing finds its place in any make up of such a course, but how shall the course be constructed and how shall it be taught.

Look over the many mechanical-drawing books on the subject, or see how the subject is taught in some of our night schools, and you will not be surprised at the question.

I would like to see the AMERICAN MACHINIST's readers express their opinions on this subject of mechanical drawing.

J. STEWART WALKER.

Jersey City, N. J.

Counting the Census Return

I have read with much interest the article entitled "Handling Census Returns for the Whole United States." I wish to draw your attention to the fact that the second paragraph of the article might be misleading, in that one could infer that before the machines which were manufactured for the Government were installed, the compiling and tabulating of the census statistics had to be done in the old way, by hand. As a matter of fact, the credit for the invention of tabulating machines for this purpose is wholly due to Dr. Herman Hollerith, general manager of the Tabulating Machine Company.

As I understand it, practically the only thing new on the equipment referred to is the punch. I am simply writing in order to give credit where it is due.

GERSHOM SMITH.
COMPTROLLER.

Pennsylvania Steel Company.

[As we have illustrated the Hollerith machine in connection with machine-shop tabulating we assumed that our readers were familiar with it and the fact that it was used in the last census. We are always anxious to give credit where it is due and have always recognized Doctor Hollerith as the inventor of this tabulating system.—ED.]

Removing Broken Center Drill Points

In looking over the AMERICAN MACHINIST I noticed on page 748, M. Jacker's suggestion for an improvement on my "scheme" (if I may use his expression) for removing the points of broken center drills. He says it is no use spoiling a twist drill to do the job but instead to make a flat drill out of a piece of drill rod and thus save expense.

But in getting down to facts I can't see it that way. First, it is not necessary to spoil the twist drill at all. When the broken point of the center drill has been removed it takes about five minutes to cut off the ⅛ inch of the drill end with the slot in it and to grind it as it was in the first place.

To make a flat drill and harden and temper it takes about half an hour.

A new 3/16-inch twist drill costs 11 cents.

Three inches of 3/16-inch drill rod at 10 cents per foot, 2½ cents; to make flat drill, ½ hour at 40 cents per hour, 20 cents; total, 22½ cents.

One-enghth inch of 3/16-inch twist drill, 1 cent; to put slot in the drill, 1 minute at 40 cents per hour, 1 cent; to regrind the drill, 5 minutes at 40 cents per hour, 4 cents; total, 6 cents.

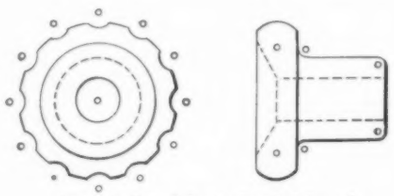
Of course, making flat drills may be good practice but I don't think M. Jacker's employer would approve of the idea.

Detroit, Mich. FRED W. CEDERLEAF.

Drawing Board Templets for Laying Out Details

I note the criticism by A. B. Howk, at page 748, of my article on the above subject, published at page 365, in which he suggests cutting the templets out of the celluloid, and drawing around the edges with a pencil, the latter being the only instrument necessary.

I would like to say that this has already been tried, and that experience has shown several objections to this method. The main objection to the plan lies in the fact that when the drawing is traced, if the centers have not been indicated, the tracer is obliged to practically redraw the object shown, as it is impracticable to trace around the edges of the templet with the ruling pen; at least the quality of the work will suffer, if the detail is not drawn with the compasses as usual. It may be economy to allow the tracer to do his part in this way, considering the relative value of the designer's and tracer's time, but I think experience will prove otherwise.



DRAWING BOARD TEMPLET

An additional illustration of the use of the templets is given in the knob shown. This particular detail is used extensively on clamping devices for jigs and fixtures, and the templet for this piece is used more often on tool work, generally, than any other.

An inspection of the piece illustrated will show the difficulty encountered by the tracer, if the centers are not pricked through, and the piece shown in full, as suggested in the original article.

T. J. S. KISHPAUGH.

Harrisburg, Penn.

On page 365, T. J. S. Kishpaugh showed a templet he had used for laying out details. He merely punched the centers. Later, on page 748, A. B. Howk suggested that the outline be cut out, and traced on the drawing with a sharp pencil. How did Mr. Howk intend to trace the drawing, or was it not intended for tracing? I frequently have occasion to trace steam motors on assembled drawings. I have these motors traced on small pieces of tracing cloth, in the two or three scales I most frequently use. The center lines are in, and the centers of all radii are marked by two intersecting lines. I merely put the center lines on the drawing, and when the drawing is traced, slip a motor of corresponding scale under the cloth, making the center lines coincide, and trace. If I understand Mr. Howk correctly, I think my method would be simpler in his case also.

Erie, Penn. DONALD REED.

Dimensions in Vulgar Fractions

On page 540 Con Wise writes a short article; "Dimensions in Vulgar Fractions Again." I fully agree with Mr. Wise that it is quite a tedious job to work with these fractions but at the same time, for several reasons do not think it would be just the thing to use the system he suggests.

I am afraid it would cause numerous mistakes as the — sign might easily be read for +, where dimension or center lines cross a dimension and while it might be used on large work to some advantage, it would be next to impossible to find room on a small detail for such a dimension as $\frac{13}{16} + \frac{1}{64}$.

It would seem certain that the only right system to use, at least in shops doing accurate work, is the decimal system, and most uptodate shops have long ago adopted it.

It is odd that so many drafting rooms persist in dimensioning drawings in common fractions, when every tool used by the toolmaker or machinist is graduated in thousandths of an inch, and the dials on every machine in the shop read in hundredths or thousandths of an inch.

The decimal system is the simplest system for calculation and no man knows this better than the man whose duty it is to check drawings. In checking, greater accuracy can be attained and mistakes will more easily be discovered. Compare Mr. Wise's addition of the fractions with the same addition performed in decimals and it is at once plain which is the simpler.

The greatest advantage, however, in using decimal fractions on a drawing, is that you can at once convey to the mechanic the required accuracy necessary in machining the part. For example: for dimensions such as fillets, etc., only two decimals are necessary and the mechanic reading 0.25 inch knows at once that this dimension is not of great importance. had it read 0.250 inch he would have known that it must be within a half a thousandth, and let it read 0.2505 inch, he knows that the dimension must be absolutely accurate.

If a system like this were to be adopted in every drafting room, I feel convinced that it would eliminate many errors and be a time saver for the shop.

H. J. SCHMIDT.

Wilkesbarre, Penn.

Cancelation of Machine Tool Orders*

By C. Wood Walter†

Cancelations follow the taking of orders that are speculative.

It is greatly to be desired that orders should carry with them a greater legal and moral obligation than than they do today.

At the same time it is not always either possible or advisable to make such orders ironclad.

*Condensed from address given before the National Machine Tool Builders Association.

†Secretary and treasurer, Cincinnati Milling Machine Company.

There are two classes of orders, so called, in the machine-tool business:

1. Orders from the machine-tool dealers for stock. This kind of order when not limited does not have a high degree of validity—and perhaps necessarily so—for no manufacturer should force his agent to take stock when the agent's sales do not justify his previous estimate. In so doing we are simply using the agent's money, thereby crippling our selling department and increasing the costs of marketing our goods. The agent's stock order is not economic—stocks can be more economically and more intelligently carried and maintained by the manufacturer at one central point in his warehouse than by his agents in their expensive stores at various points. This is not inconsistent with the policy of carrying a proper line of sample machines on the agents' floors. Agents' stock orders for the most part, serve only to record the agent's judgment as to what the future demand may be in his territory. Many manufacturers therefore no longer accept agents' stock orders. Where they *are* accepted it should be for limited quantities only and made not subject to cancelation.

2. The order of the second class is the order from the actual purchaser, the user of the machines, placed with the dealer or with the manufacturer direct. Many manufacturers are coming to regard this as the only order that is truly significant. But even this order, as commonly understood, falls short of being an actual contract. A large percentage today of machine-tool buyers place their orders with the mental reservation that they can easily meet a change in their plans, or a change in the market demand, by a cancelation of the order any time prior to shipment date. To some extent this cancelation privilege has been written into the order with the sanction of the dealer, or against his protest. To some extent the dealer has encouraged the buyer to reserve machines, subject to cancelation, and such reservations have been turned in as orders to the manufacturer who forthwith proceeds to invest his money to fill "the large orders on his books." I do not speak of the cancelation based on failure to deliver or on any other legitimate grounds.

Suggested Change in Machine-tool Orders

Now it does seem that the machine-tool order as it exists today, might most profitably be subjected to a reform, so that it shall represent a contract, not subject to cancelation, the option of granting a cancelation to rest entirely with the vendor. Consider what an added stability would be given to our industry today, if the unfilled orders on our books represented actual contracts not subject to cancelation! Consider what a change such a condition of our order books would have made in the fall of 1907!

Evils in Present Practice

Let us review a few of the evil results that follow from the present practice of filling up our books with so called orders which do not represent binding contracts:

1. The manufacturer invests his money in materials and wages to finish machines on order, only to find when they are finished, that he may not have orders for them.

2. The manufacturer increases his production schedule to keep pace with his big order book. When his order book suddenly collapses under wholesale cancelations, he is left with a big stock on hand and coming out, with consequent heavy interest charges and often with heavy contracts for materials which he himself cannot cancel. This situation forces him to immediately curtail and run on a losing basis. It is bad enough to suddenly strike a market where new orders are scarce, without having to face a wholesale disappearance of the old orders.

3. Manufacturing on the basis of an artificial demand (as reflected in an artificially padded order book) makes also an artificial demand for material and labor, and a consequent increase in their cost. This is equally true for the dealer, who pays out his money to sell the goods, and increases his salesman's wages because the salesman is piling up big sales—which finally may largely disappear under cancelations.

4. Most disastrous of all—these wholesale cancelations under a slump in the demand, leave the manufacturers with such an over-production on hand, that the stability of prices is immediately and most seriously threatened.

But our industry should not be subjected to such a strain as this. Once a demoralizing break in prices takes place, it will take years to recover. Now it is my opinion, that we will take a long step in the direction of preventing this possibility, if we will cut out the cancelation privilege. Consider some of the benefits which would follow the establishment of the practice which would make a machine-tool order not subject to cancelation.

Benefits from No-cancelation Provision

1. The manufacturer may make his contracts for materials, arrange his manufacturing schedule, regulate the growth of his plant, with an actual knowledge of the amount of his product which he has absolutely sold, and which will stay sold.

2. The machine-tool dealer or agent may proceed with the development of his business, with the definite knowledge that he has earned so much profit based on his sales already made, instead of facing the possibility of a threatened and finally absolute loss when he is confronted with a flood of cancelations.

3. If the manufacturer can regard orders as actual and absolute sales, he can then intelligently and economically govern the amount and variety of stock he shall make, since he may approximately measure the actual and real demand for his various items of product.

4. Under a slump in the demand, (which in the beginning is often more or less artificial) the orders remaining on the books, if actual and collectable, may be sufficient in the whole industry to bring about at least a partial resumption of business and restoration of confidence—at least the manufacturer would have time to reorganize his production without the disasters of sudden and drastic curtailment. This same benefit would accrue alike to the dealer.

It may not be always desirable or entirely possible to make a machine-tool order absolutely ironclad, but it is certainly most greatly to be desired that it should carry with it the force of a greater legal and moral obligation than it does today.

Extracts from Other Papers

By Murray Shipley *

If there ever was a case where an "ounce of prevention is worth a pound of cure," it lies in preventing the cancelation of orders in distinction from forbidding it.

In my opinion, the first step to be taken is to refuse to enter an order, excepting when the name of the buyer and shipping instructions accompany the order, with two objects in view:

First—To make it difficult, if not impossible, for the merchant or dealer to purchase for future delivery what he may not be able to take and pay for, and

Second—To keep all of the product unsold to consumers in the hands of the manufacturer, that each and every one of his merchants may have available for a prospective order all machines of the given make that have not been *bona fidely* purchased by consumers.

If, in addition to this, there be developed a uniform purchase contract forbidding cancelation, which each and every machine-tool salesman shall be required to have duly filled and signed by the purchaser before the order will be accepted by his firm, very much will have been accomplished toward eradicating this unfair and dangerous practice from the machine-tool business.

What prompts cancelation of orders is "plunging" on any given product. For the manufacturer inflated orders create conditions which, if sound and true, would warrant his extension of manufacturing facilities and goods in process of production, but which, when panicky times come, suddenly prove false and dangerous and add to the already alarming conditions brought about by small and diminishing receipt of new business.

*Treasurer, Lodge & Shipley Machine Tool Company.

By William B. Reid *

The over zealous customer makes preparations disproportionate to the actual demand, without having an appropriation from the financial department of his institution, setting aside from net liquid assets the purchase price of fixed equipment. The more sanguine the customer is regarding the prospects of his own business, the more likely is he to order more machinery than actually required to execute his orders, relying on the fact that he can cancel his orders before delivery, because it is not difficult to find some excuse why the dealer should accept cancelation. If delivery has not been made in reasonable accordance with the dealer's promise, the customer has a right to cancel his order. If the customer has, for financial reasons, found it necessary to retrench, and the dealer on investigation finds the customer has no strong reserve with which to meet his miscalculations, he will gladly accept cancelation, fearing that if he made delivery he would have an uncollectable account on his books; a feature with which the builder under the present conditions is, as a general rule, not familiar.

We are all agreed that cancelations are not a good thing and must be discouraged, but I do not believe any fixed rule can be laid down at this time which would cover all cases, but we must pay attention to the signs of the times, for visions of things to be done come a long time before the way of doing them appears clear.

Some builders have, for several years, reserved the right to limit the size of stock orders, thus enabling them to distribute their product according to the actual demand; now it is quite evident that if these builders resolve to accept no cancelations from the dealers, they will defeat the object which they have for several years worked to attain, for if a dealer in one locality should, owing to industrial conditions, be compelled to accept cancelations from his customers and is financially able to carry the surplus stock during a period of depression, he will certainly not relinquish any stock when trade conditions improve and other dealers are compelled to wait on factories for deliveries; which simply means that the builder received his business from the dealer in one locality in advance.

I can safely say that in the machine-tool industry there are less petty claims for defective material, damage in packing, differences in count, breakages in transit and inferior quality, than in any other line of business. Your product is a staple one, therefore cancelations, except in cases of special attachments, do not work a great permanent injury unless the price of raw material should drop below the cost of that used in the preparation of your product for customers' orders which are canceled before completion. In some lines of business there is practically no salvage in canceled orders, owing to the seasonable nature of the business.

*Marshall & Huschart Machinery Company.

A Faceplate Drive for a Large Lathe

By W. R. Oakes

Figs. 1 and 2 show a faceplate drive for a large lathe. Instead of driving from the faceplate pinion *a*, which usually has a small number of teeth, into the faceplate wheel *b*, which has a large number, an intermediate wheel *c* is used, much larger than the pinion *a*. The idea is to follow out the same principle for smoother running, as a rack-planing machine drive, where an intermediate or bull wheel is used between the rack pinion and the rack. Another point about this arrangement is the extra outside bearings *d* and *e*, just where they are needed, instead of the usual overhang of the faceplate pinion. In the case of the outside bearings, there is no overhang, because of the bearings *d*, *e*, *f* and *g*, on each side of the faceplate pinion *a* and intermediate wheel *c*. The rest of the headstock consists of a single-gear drive, by locking the wheel *j*, which is keyed to the faceplate pinion shaft, sliding the wheels *h* and *m* out of gear with the wheels *j* and *l*, and so driving through the faceplate pinion *a* and intermediate wheel *c* into the faceplate wheel *b*. A treble-geared drive is obtained, by unlocking the wheel *j* from cone pulley and sliding the wheels *h* and *m* into gear with the wheels *j* and *l*, as shown in Fig. 1, and so driving from the cone pulley through the wheel *l* into *m* and the wheel *L* into the wheel *j* on to the faceplate pinion shaft; then through the intermediate wheel *c* into the faceplate wheel *b*.

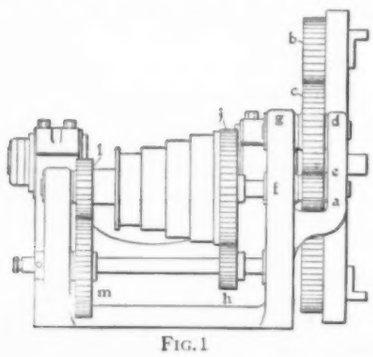


Fig. 1

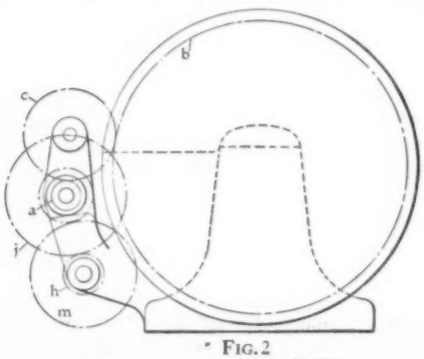


Fig. 2

American Machinist

A Faceplate Drive for a Large Lathe

Machine Tools in Auto Manufacture*

By Robert Pierpont †

Standard machine tools supplemented by special machines, both kinds simple in design, easy to operate and not liable to get out of order, are the requirements of automobile manufacture.

*Condensed from address before the National Machine Tool Builders Association.

†Works manager, Olds Motor Works, Detroit, Michigan.

Where we are making such large quantities of automobiles there is a great saving in the use of special machinery, even if used for but one season. The large output of one model helps this, as we could well afford to spend $30,000 to experiment and make the tools for a rear axle if we were making 20,000 cars, as it would mean only $1.50 per car and would save several times that, but on 1000 cars it would be $30 per car.

In regard to special machinery designed for special purposes, it has usually been considered by a salesman a good argument to say that the entire cost of the machine can be saved in one season's business, in comparison with the cost of doing the same operation on a standard machine. I am strongly in favor of special machines, which do pay for themselves in this way, provided they are simple and easy to operate and not liable to get out of repair.

We have two extremes of opinion in regard to special machinery. A friend of mine, who formulates the policy of a large automobile concern, keeps selling his old machinery to buy new, as fast as something which he thinks is better comes out; consequently, he does not believe in very much special machinery, as he would not be able to sell it as readily as he does the standard tools. Others go to the other extreme and will buy special tools for everything, as fast as they come out, whether there is much of a saving or not. I hardly think either extreme is the better policy. It seems to me there is a large field for standard machines, somewhat simplified, to be used for special purposes; these to be sold at a cheaper price in quantities, but so built that the full complement of attachments could be added at any time desired. This brings up a point which I wish to emphasize, which is "simplicity."

Simple Machines

I think we need simpler machines with fewer feeds and speed changes, rather than machines more complete and complicated. In the ordinary use of machinery it is not necessary to have quick change of gears as the majority of our men run day after day on the same piece or cut, and in getting out pieces in large numbers it is more advantageous to keep a man doing a certain piece of work as he is apt to do better and more pieces the longer he is at it. The adjustments of the bearings should be simple and easy to understand and operate. Good foremen are getting scarce, and we need machines which will require but little attention.

Referring to the gearing of the machines, both for driving and speed changes, I notice that our machine shops are continually getting more noisy, and I think you will all agree that when we want a man to do a really nice job, we get him off in some quiet place to work. The noise of gears running and shifting attracts the attention of men from their work, and it takes them a long time to get used to it; especially is this true of unskilled labor. This is another reason why I would favor a more simple machine, which would also be more quiet in operation.

Still another reason for favoring the special machine is in taking care of repair parts. The time is already here for some of the automobile manufacturers, and will come to all of the large producers, when they will not be able to take care of the repair parts for outstanding cars in the regular production machine shops, but will have to make special departments where these repair parts can be produced. If we have any special machinery used in this year's product but not in next, we can turn this machine over to that repair department and continue to make these pieces at a cheaper cost than could be done on standard machines, which will all go to help the upkeep for the car owners.

Motor Drives

I imagine the question of the direct-connected, or motor-driven machines, is receiving considerable attention at your factories. It has always seemed to me that special machinery, or that adapted to doing one thing, was the ideal tool for a direct-connected one, as the load will be fairly constant. It very often happens that a special tool will do so much work that it will be necessary to run it only part of the time. If motor driven, it could be shut down for the remaining part of the day without cost.

It does not seem practical to me to equip all standard machines with motors as on a standard machine the work varies in style, quality and power necessary to accomplish the desired result, as at one time we might be using only one horsepower, and at others 10 to 15, or whatever the capacity of the machine might be. For example, if we took a room of 20 milling machines and equipped them all with 7½-horsepower motors, the sum would be 150 horsepower, whereas very likely the whole room could be run to better advantage with one 50-horsepower motor, and we would have the difference in investment between the 20 7½-horsepower motors, as against one 50-horsepower.

There are a number of machine tools built, which, under certain conditions, can remove an enormous amount of stock, but the jobs are very few on which we can use a machine to the limit of its power. On the great majority of pieces that go to make up an automobile, if we held the piece tight enough to remove the material as fast as the machine will cut it, we would spring the piece out of shape. If we do not spring it in holding, it will spring when we let it loose. I have very seldom seen in actual use a cone-driven machine which would not do the work as fast as the piece or fixture would allow it to be done. As the single or geared machines must necessarily cost more money and the wear and tear on the whole machine is greater, I am inclined to believe that in a few years we will, most of us, be of the opinion that the single belt-geared drive was not the success which we had expected.

It is not many years since the cutting-tool or steel man came around and told us that his steel would stand more than the machine was able to do, but I have not heard that remark passed in the last two or three years, which goes to show that the machines themselves have been perfected beyond the tooling point. It is all very well for a manufacturer to say that his machine will remove so many cubic inches of stock a minute, but in actual practice that does not interest us as much as to have the machine run 365 days in a year if need be, without repair, and do one piece after another with perfect accuracy.

Milling Machines

Modern milling machines are very powerful, and have all kinds of feeds, and quick-change gears for feeds, speeds, etc. Now these same machines are just like the universal milling machine, except that the table does not swing. As only a small part of the work done on a universal miller requires the moving of the swinging table, the machines are knee type and to all intents and purposes universal. As a rule, we use universal machines chiefly for tool work. The question I wish to raise is this: Do we need all these attachments and feeds in the

same machine? Why not make them optional?

Lathes

The same thing applies to lathes. We buy lathes with all kinds of quick-change appliances, feeds, stops, etc., but do we really need them, or do we buy them because you force them on us against our will? We do, however, like the wide heavy carriage, the large bearings, and rigid tailstock. A lathe used to be a simple machine; it was one of the first, if not the first, on which we started the apprentice to work.

You are getting lathes to a point where they are almost universal in scope. I do not think we want a shop full of universal machines, the greater part of the attachments on which will never be used. There is very little work we finish on a lathe now. No matter whether it is straight or taper, inside or outside, we invariably have a little to grind whether it is to be hardened or not. This makes the lathe only a roughing machine at the best, but it must be able to rough accurately and true, in order to leave a uniform amount to grind or finish.

Grinders

The manufacturers of plain grinders are moving in the right direction by making their machines heavier. High-speed machinery must be heavy and stand firmly on the floor or foundation in order to be satisfactory. I do not think it pays to be saving with your iron in the designing of grinding machinery.

We are using water grinders in new ways more and more, and find they give the cheapest finish as well as the best and most accurate. This applies to soft parts as well as hardened ones. We want in the future to finish more and more from the rough casting or forging without any previous or roughing operation. This applies to round as well as flat surfaces.

Drills

In the way of drilling and vertical boring machines, we have used and shall continue to use still more multiple and special tools. While we now drill 10, 15 or 20 holes on one side of a piece, I see no reason why we should not be drilling as many more on the other side at the same time, just as we mill a piece on two or three sides at the same time.

We are using the gang drill press in successive operations to good advantage, and on large and long holes are getting a very cheap production, as one man can run a number of presses in one gang or set.

I think there is a market for some horizontal boring and reaming machines with two or three spindles, having movable centers for boring out crank cases and transmission cases.

Screw Machines

On the automatic screw machine we want greater production with accuracy. We also want machines which require the minimum of repairs. In the hand screw machines we are looking for new and original ideas for holding and tooling the pieces for chuck work and second operation. Some of the large bar machines are going to prove to us that they can make gear blanks cheaper from the bar than from the forging. The turret-machine builders have the right idea in enabling us to buy the bare machine or with as many outfits or tools as we require.

Gear Cutters

Regarding gear cutters, I do not think of anything other than what I have said in a general way. I do think, however, that someone should get up a machine or attachment for grinding rotary gear cutters and hobs after they are hardened so that they will be absolutely correct. It might make the cutters more expensive, but with the increased wear we get from high-speed steel, they would be well worth the money.

Special Machinery

As I have already told you, I am in favor of special machinery for doing one thing, and that well and quickly, and I will give you two or three examples which perhaps you may not think of. We are all using square holes more or less in our transmission gears. There should be a good sale for a machine to bore out a round hole into a square one, within a reasonably close limit. This could be done either vertically or horizontally, and does not seem to me to be a very difficult operation. We would be willing to run a sizing broach through if it were necessary, but when we have to broach out a long sliding-gear hub made from high-grade alloy steels from the round hole, it is a long and seemingly unnecessary operation.

There are an enormous number of cotter-pin holes to be drilled in the ends of bolts and studs. I do not see why we should not put them into a hopper and have them come out all drilled automatically.

The same is true of castellated nuts. I do not see why these should not be slotted by an automatic machine as well as threaded.

Then we have the square shafts that fit in the same square holes. These should be ground with a form or master doing the flats and corners all in one operation, in the same manner in which we are now grinding the cam shafts. After machines of this character have been perfected, I do not see why they should not be standardized and sold as such.

Slow Running Gasolene Engines

A gasolene engine is one of the handiest sources of power when repair work or small jobs are to be done and the main engine is not running. It also frequently happens that it is necessary to run a gasolene engine at a very low rate of speed. Most of the stationary gasolene engines refuse to operate below a certain speed, and attempts to run such engines slower, result in continual stopping, and a tedious cranking of the engine every few minutes.

The usual cause of failure to run at a very slow speed will be found to be due to the failure of the induction stroke of the piston to draw in with the air a sufficient quantity of gasolene to properly impregnate the air taken into the cylinder. To be sure, this is modified to a great extent by the type of carbureter used with the engine, but it will usually be found that by throttling the air supply as it is drawn into the engine, the increased velocity thus imparted to the entering air, will pick up the gasolene with certainty.

In the type of engine which is fitted with a place to lay a finger over the air-induction opening, for throttling the air when necessary, it is sufficient to bend up a strip of tin and let it clasp itself around the air induction pipe. As much or as little of the air opening may be covered as is found necessary and when the right adjustment has been obtained, a dent in the tin, made with a hammer will prevent any movement of the tin in relation to its position over the induction opening and the engine will run much slower when thus adjusted. One explosion in 10 or 12 revolutions of the crank shaft is easily obtained by this method, even when the engine would stop at one explosion in five or six revolutions without the tin application.

Although little is known about the effect of vanadium on aluminum-bronze, it has been stated that an aluminum-bronze containing 91 per cent. of copper, 8 per cent. of aluminum and 1 per cent. of vanadium has a tensile strength of 123,000 pounds per square inch (45 English tons) and 12.5 per cent. elongation. This strength is said to be possible on cast metal.

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American Machinist

Editorial

The Value of Rapid Clamping Devices

We are all familiar with the old saying of "saving at the spigot and wasting at the bung." And we often see where the other fellow is guilty of just such foolishness.

One frequent example of this—in the other fellow's shop, of course,—is the use of high-speed, special machines, which save time, and the use of antiquated methods for holding the work which often waste all that you save.

Perhaps as glaring a case of this kind as any is the use of the old "C" clamp, with a screw, for holding work under a high-speed drilling machine. It seems incredible that holding fixtures will be designed which include this slow method of clamping, but such seems to be the case in many instances.

One of the cardinal principles of almost any fixture is a quick-clamping device, this being second only to that of holding the work accurately. But even where fixtures are not used, and the work is clamped to an angle plate or other holding device, a quick-acting clamp should be provided. An eccentric cam or even a wedge, will usually be found quicker than the screw clamp, with its tendency to crowd off the desired spot.

Poor holding and clamping devices can lose more time than a good machine can save in many instances.

The Good of the Industry

It is probably safe to say that no one machine or method is best for all purposes. Every enthusiast believes that his machine or method is an exception until he has had enough experience to show him the truth of the statement, after which he becomes a more useful member of the profession.

Bearing this in mind, as well as the fact that we should know where *not* to use a certain machine as well as where it is most useful, we see the advantage of knowing the arguments of the other side, in every case.

This was clearly shown at the discussion on cone vs. geared head machines at the convention of the National Machine Tool Builders' Association. Extracts of these papers have already appeared. After considerable discussion, it was pretty generally agreed that where it was necessary to secure an excess of power in a small space, the gearing was the logical solution, but that in the great majority of cases, the cone-driven machine had all that was required, so that, instead of being a question of which was always best, it becomes a question of when to use the cone and when the geared head.

This is practically the case with almost every machine-shop problem, whether it be geared heads, motor drives or other questions. The sooner we realize that the good of the industry demands the selection of the best type for each case instead of a war of extermination of either, the better for all concerned.

As a journal of machine construction, it is clearly the duty of the AMERICAN MACHINIST to discuss freely the advantages and disadvantages of all types of machines, that the best may be chosen for the particular work in hand. And it should be fully understood that the aim of all discussion is to aid those responsible for results to determine the best device for their purpose and not to discredit any type of machine which may be under discussion.

It is our privilege to be able to view the various problems from a little distance and so, perhaps, secure a better perspective than is possible when one is in the thick of things. But whatever is printed in these columns, either editorially or in discussion, is intended (whether it succeeds or not) to make for the good of the industry as a whole.

The Passing of Attachments in Manufacturing

It is the most natural thing in the world for the ingenious mechanic, be he young or old, to study out new attachments for whatever machine he is working on. Who of us has not planned, and built if the boss would let us, a milling attachment for the lathe or a tool-post grinder at the very least?

All this is perfectly natural and proper and many of these attachments gave excellent service in the old shop—but they have no place in modern manufacturing.

There are many shops where a milling machine with its various attachments is worth its weight in gold, but only because they do not have work enough to keep a machine for each purpose busy enough to warrant its purchase.

Real manufacturing demands a machine

built and used for a specific purpose, without frills or attachments beyond those necessary to perform its legitimate work.

Conditions vary to such an extent that no iron-clad rule is possible. It may be cheaper to put a milling attachment on a planer rather than handle the work a second time, but such cases are rare as the cost of tying up the planer during the milling operation must be carefully considered.

It is a pretty safe rule to avoid attachments of any kind on manufacturing machines. If any of us had the money tied up in attachments that have been abandoned or never been used at all, we need not be troubled by the latest advance in the price of beef.

Difficulties

Ever since men were men we have had to fight difficulties. We are likely to keep on in the same way until the end of time. All the world loves a fighter provided only he fights fair. We are not referring to fighters in the military or sporting sense, but to the men who have gotten out and pushed when the mechanical world has been mired. Sheer persistence, everlastingly keeping at it has won many a fight and a bit of head work and a little tact a great many more, but of all the winners, the man who takes adversity and makes her fight with him and for him, is the one whom we worship.

When we see some great thing accomplished and read its history, we are apt to think that the course which it followed was as it was laid out in the beginning. As a matter of fact the best engineers of men and material are those whose original plans run off into ramifications as wide as a genealogical tree. The true engineer foresees difficulties and criticisms and he either goes around them or through them with studied forethought; and if baffled in one way, he simply congratulates himself that there is another way. He keeps his ear to the ground for legitimate criticism, but only for that which is legitimate; he is always expecting trouble, never courting it; he never crosses a bridge until he comes to it.

But let such a man once lose his grip, his confidence, and he is hopelessly at sea; then every bit of criticism, fair or unfair, nerves him up. Every little pebble in the roadway looks like a mountain and he knows not where he will steer. Then he learns that the world hates a quitter; hates him with an unreasoning hatred, that cares not if he be sick in mind or body, but only sees that he has quit. The only way a man can quit and live at peace with the world is to begin a new tack before he quits the old—and that is not quitting.

William P. Davis

William P. Davis, president of the W. P. Davis Machine Company, Rochester, N. Y., and a well known figure in the machine-building industry, died at his home in Rochester on May 30, after a very brief illness.

Mr. Davis was born in Lima, N. Y., in 1850, and after obtaining a common school education, he went to work as an apprentice at the age of 14 in a machine shop at Auburn.

WILLIAM P. DAVIS

Mechanically inclined by nature, he took to his first work in a manner that displayed marked ability. Early in life he was taken with a desire to embark in business for himself, and when only 22 he started a small machine shop in North Bloomfield.

From 1874 to 1890 he conducted his business in a rather modest way in several small towns, but in the latter year his tendency to expand the business took him to Rochester in considerably enlarged quarters.

Four years later the business was organized under its present name, with Mr. Davis as its head, and three years ago a modern factory was erected for its use.

By his genial nature, Mr. Davis had become popular with his business friends and associates as well as in his local social world. One of the last things he did to promote the high esteem in which he was held in the machine-building industry, was his work in connection with the committee of arrangements for the recent convention of the National Machine Tool Builders' Association, his attendance to which was prevented by his last illness.

Besides an aged father, his wife and one daughter, Mr. Davis is survived by his brother Charles F. Davis, who is secretary and treasurer of the W. P. Davis Machine Company.

Engineering Building for Boston

Plans have been formulated by a number of scientific and technical societies of Boston for a joint engineering club and societies' building in that city, and those in charge of the proposition have had plans drawn up for the proposed building. The building as planned, will be practically in halves, the club part to face on a residential street and the office, or the society section, on a business street. It is proposed to select the membership as far as possible from the engineering, architectural and scientific professions with an initiation fee of $50, annual dues of equal amount for resident members, and one-half this amount for nonresident members. The secretary, L. S. Cowles, 101 Milk street, Boston, requests those interested to forward to him their ideas on the club, and their views with regard to membership.

PERSONAL*

S. Noda, proprietor of Roku-Roku Shoten, Inc., machinery merchants of Tokio, Japan, is in this country on a tour of inspection and business trip.

N. E. Hildreth, recently superintendent of the factories of Carlisle & Finch Company and the Clifton Motor Works, Cincinnati, Ohio, is now superintendent of the Witte Iron Works Company, Kansas City, Mo.

Joseph H. Dalton, formerly foundry superintendent of the Jeffries Manufacturing Company, Columbus, Ohio, has recently accepted a position as superintendent of foundry with George H. Thacher & Company, Albany, N. Y.

F. R. Pleasonton, formerly assistant consulting engineer of the Smith & Durbush Machine Company, Philadelphia, Penn., has become assistant to the superintendent of the Pennsylvania Steel Company's machine shop at Steelton, Penn.

C. H. Kingsbury, for the past 12 years manager of the Niles-Bement-Pond Company, Boston office, will take an extended vacation of several months, on account of ill health. Previous to his departure, the managers and heads of departments of Hill, Clarke & Company, Inc., Chandler & Farquhar Company, Prentiss Tool and Supply Company, and Manning, Maxwell & Moore, called upon Mr. Kingsbury to extend best wishes, and presented him with a masonic charm as a token of friendship. Mr. Eastabrook, of the company's New York office, will have charge during Mr. Kingsbury's absence.

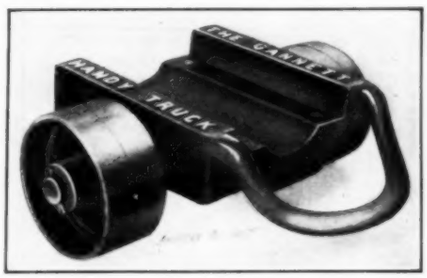
*Items for this column are solicited.

New Tools and Shop Appliances

A Shop Truck

The halftone shows a truck known as the Gannett handy truck, and built by the Gannett Electrical Company, 55 Pine street, Providence, R. I.

The space between the sides admits the feet of most heavy machines. A truck of any length can be made by placing two of the trucks in line and placing a heavy timber on top. Two more similarly treated completes a truck which can be made any width. The body of the

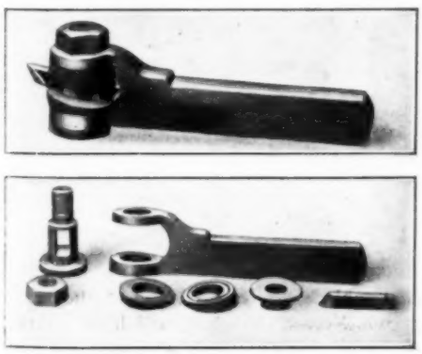


A Shop Truck

truck is slightly higher than the wheels and bolt holes are provided in it for securing timbers thereto. The groove in the center is for holding pipe or shafting. It weighs about 30 pounds.

A Tool Holder

The halftone shows a tool holder which is being put on the market by the Kearney Foundry, Machine and Automobile Company, Kearney, Neb. The tool can be turned to any angle, right or left, and the wedge-shaped washers permit vertical adjustment of the point. By means of these washers, a straight threading tool can be tilted to the angle of either a left- or right-hand thread.



Tool Holder

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

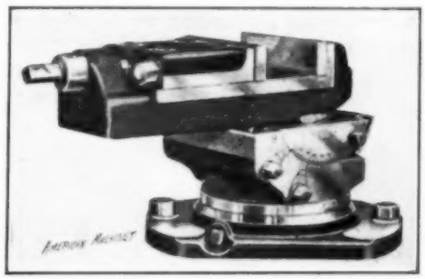
A Manufacturing Milling Machine

The halftone shows a milling machine, a number of which have been built by the Lamb Knitting Machine Company, Chicopee Falls, Mass., for its own use. The machines have proved so satisfactory for its own work that the concern has decided to build them for the market. They will take work 48 inches long by 13 inches square. There are three speeds and three power feeds with automatic stop and quick return by hand. The table is T-slotted as shown, so that fixtures can be bolted to it.

A Manufacturing Milling Machine

The Aetna Three-way Vise

The halftone shows a new milling-machine vise which has been put on the market by the Becker Milling Machine Company, Hyde Park, Mass. It is clamped to the milling-machine table by two bolts; the work can then be clamped in the vise and set at any angle without disturbing the holding-down bolts. Both swivels are graduated to degrees. The jaws are 5 inches wide, 1½ inches deep and open 3½ inches.



The Aetna Three-way Vise

Method of Mounting Patterns on Plate

A new method of mounting patterns for use on the molding machine, or on the bench, has been developed and thoroughly tried out by Hugh McPhee, the superintendent of foundries of the Maxwell-Briscoe Motor Company, Tarrytown, N. Y., covering which there are patents pending.

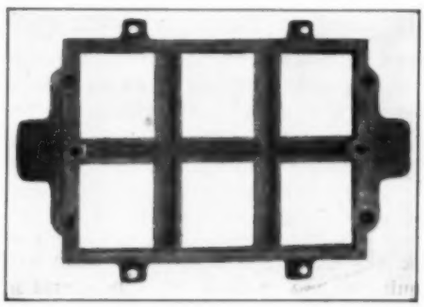


Fig. 1. Frame for Match Plate

This method is especially applicable to small work that can be attached to a gate, and numerous castings made in one flask. A master pattern is first made of the desired piece, and enough white-metal pattern castings are made from this to fill the flask. These castings are then cleaned up and finished so they can be used as patterns, and no more pattern work is necessary.

The white-metal patterns are then molded in the drag and the proper parting made; thus irregular-shaped pieces can have the parting easily made in the sand, and when the match board is made it conforms to these irregularities. The cope is then placed on and rammed up and lifted off. Metal is poured into each impression in both the cope and nowel until it is filled flush with the parting line, a small ladle being used. By pouring each pattern individually without pressure, a smooth and perfect casting is obtained if the proper mixture is used.

An iron frame similar to that shown in Fig. 1, with the proper holes or pins in it to fit the flask, is then placed over

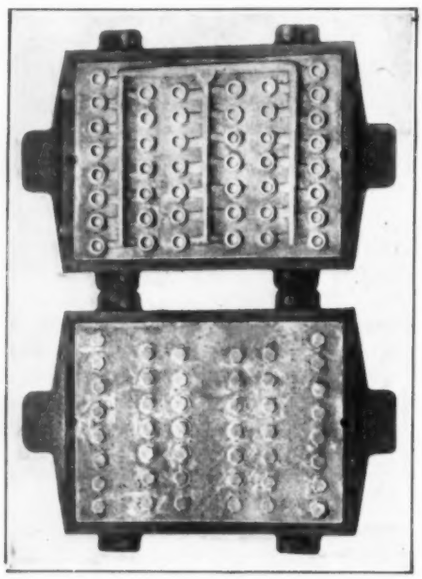


FIG. 2. COMPLETED COPE AND NOWEL MATCH PLATE

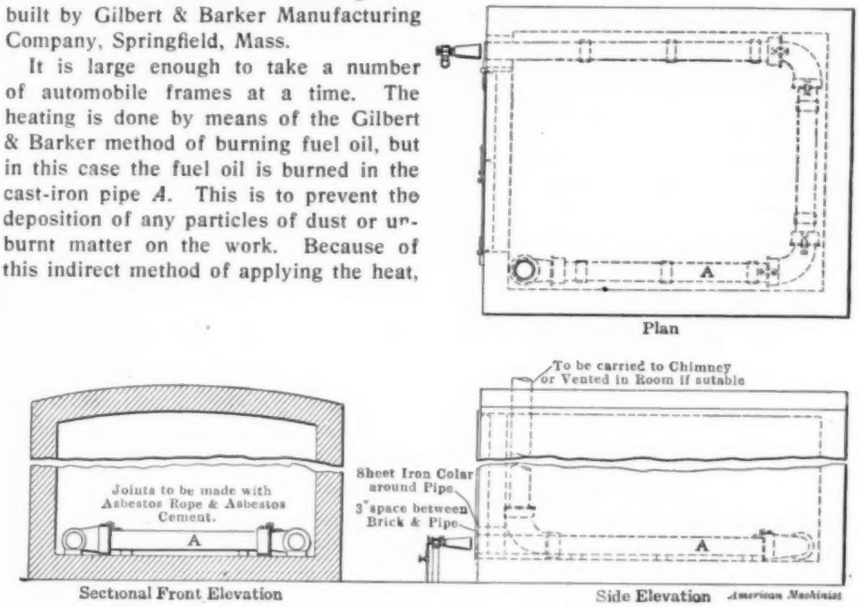
both the cope and nowel, and a composition metal is poured into them until it forms a solid casting with the metal that has filled the pattern impression. The composition is held in place by a bead around the inside of the frame. A piece of emery cloth will then do all the finishing that is required, and castings can be made from these match boards either on the machine or on the bench, providing the proper interchangeable flasks are used.

A sample of the match board for the cope and nowel, as it is completed and ready to mold, is shown in the halftone, Fig. 2.

An Enameling Oven Heated by Fuel Oil

The line cut shows an enameling oven built by Gilbert & Barker Manufacturing Company, Springfield, Mass.

It is large enough to take a number of automobile frames at a time. The heating is done by means of the Gilbert & Barker method of burning fuel oil, but in this case the fuel oil is burned in the cast-iron pipe *A*. This is to prevent the deposition of any particles of dust or unburnt matter on the work. Because of this indirect method of applying the heat,



AN ENAMELING OVEN USING FUEL OIL

the oil consumption is comparatively high, seven gallons of oil equaling 1000 cubic feet of city gas.

A Pneumatic Lathe Chuck

A line of air-operated chucks has been put on the market by the Bashlin Tool Works, Grove City, Penn. The chucks are in two styles with two and four jaws, which are hinged on the head of the draw-in rod. The other end of the draw-in rod is attached to the piston of the air cylinder, which is, of course, in line with the spindle and at the back of it. A closer screwed on the nose of the spindle closes the chuck jaws on the work when the air is admitted to the cylinder.

A Bar Shear

The Thomas Carlin's Sons Company, Henry W. Oliver building, Pittsburg, Penn., has brought out a new bar shear known as its Number 21. This shear is of the so called alligator type, and while intended for cutting muck bar to length for the crucibles, it can be used for cold cutting any soft-steel bars up to 1¼ inch square.

A Plain Automatic Screw Machine

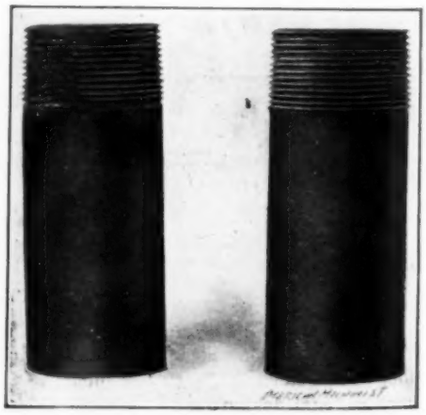
The National Sewing Machine Company, Belvidere, Ill., has placed on the market a new automatic screw machine. The bar stock is fed to the tools by a positive cam movement which controls the length of feed. Forward and reverse belts drive the spindle in either direction through a suitable clutch.

Any one of the range of geared feeds is instantly thrown into engagement by means of a positive clutch. The turret is of the horizontal type.

Cutting Compounds

Many different compounds are being used as a cutting lubricant or coolant, all having their special advocates, and most of them apparently giving very good results on the particular work to which they may be adapted.

The newest thing in this line that we have found in use is an application of the latest product of the International Acheson Graphite Company, known as Aquadag. This is a composition or mixture of deflocculated graphite and water, so intimately mixed that the graphite remains in suspension at all times and will pass through a fountain pen or go through



EXAMPLE OF THREADS CUT ON OLD PIPE

the finest filter paper without depositing the graphite during its passage.

Some time ago superintendent of the shops of Root, Neal & Co., Buffalo, N. Y., had an exasperating experience in threading some very poor pipe with an old die. All the cutting compounds tried, including lard oil, were unsatisfactory, producing a thread as shown at the left in the figure.

It was an odd job, and it was out of the question to wait for a new die. Having a sample of Aquadag, he prepared a cutting compound from this and immediately produced the thread shown at the right. This was probably due more to its lubricating than its cooling qualities, as it evidently prevented the thread being torn by the die, as in the former case.

Working along these same lines, the Niagara Machine Company, Niagara Falls, N. Y., has been experimenting with this in one of its cutting-off lathes, and the results obtained read so much like a fairy tale that we should hesitate to repeat them if they were not vouched for by an official of this company.

In this case the Aquadag was mixed with the soap cutting compound which they were using, and the results noted on cold-rolled steel rods averaging about one inch in diameter. Their records show that the cutting-off tools would make about 60 cuts between grindings, but that after adding, the other 980 cuts were made with one grinding. It is also claimed that the resulting work was smoother than in the first case.

They also cite an interesting experience in boring and reaming bronze bushing. In reaming with the usual cutting compound the hole was invariably found to be about 0.0002 inch smaller than the reamer used, but when using the graphite in the compound, the hole was the full size of the reamer.

This seems even more difficult to understand than the experience in cutting off, as one would suppose that the lubricating qualities of the graphite would tend in the other direction. This seems to be particularly true when we hear the further claim that it requires less power to run with the graphite, as in the case of a reamer the lubrication must be between the lands and the holes being reamed.

In other operations it is claimed that an open belt can be used where it was formerly necessary to make use of back gears.

Further experience along this line will be watched with interest, as anything which adds to the output of our present equipment makes for the general good of the industry as a whole.

Spring Meeting of the A. S. M. E.

The annual spring meeting of the American Society of Mechanical Engineers opened at the Marlborough-Blenheim, Atlantic City, on Tuesday, May 31, with a registration, including the members and guests, of about 200. The first day was devoted to an informal reunion of members, the professional sessions beginning on Wednesday morning.

Wednesday Session

The professional sessions opened with President George H. Westinghouse in the chair. A report was given by a committee appointed to consider legislation in connection with the licensing of engineers in the State of New York. There seems to be a desire on the part of many young engineers to establish a legal requirement for the practice of engineering; however, this desire does not seem to be widespread throughout the profession with a possible exception of those who are particularly engaged in what is ordinarily referred to as "civil engineering." The committee recommended that all such legislation be considered by a duly authorized committee of the society in connection with whatever legislative committee had the bills in charge.

The first professional paper was presented by Wilfred Lewis, in which he discussed the mechanical principles of the shockless jarring molding machine. This machine has been described in our columns at page 40.

Prof. Walter Rautenstrauch, in a paper entitled "A Comparison of Lathe Headstock Characteristics," made a plea for a more rational design that should do away with the present rule-of-thumb methods. By way of discussion Mr. Barth objected to some of the formulas used by the author, stating that in the work of F. W. Taylor, equations had been developed that were of more value than the ones taken from the work of Professor Nicholson. Several members commented favorably upon Professor Rautenstrauch's work, and laid stress upon the need of a careful investigation of the elements of design in machine tools in order to get away from the present irrational methods.

Perhaps the most interesting paper of the morning was by Prof. A. L. Jenkins. A large number of experiments had been made with specimen cast-iron punch frames, in order to prove or disprove the value of the accepted formulas for designing such members. As this paper will be presented in extended abstracts in a following issue, for the purpose of this report it is sufficient to say that Professor Jenkins reached the conclusion that the well known beam formula

$$S = \frac{Mc}{I} + \frac{W}{R}$$

is the most accurate statement of the law of stress relations existing in such specimens. Also the Résal and Pearson-Andrews formulas are unwieldy and awkward in their application and offer many chances for error.

In discussion, Professor Rautenstrauch gave the results of a few experiments made by him with similar specimens. Taking Mr. Andrews and Professor Pearson's formula and substituting values applicable to these castings, it was found that $S = 2.935\ W$. From the test of casting No. 1 it was noted that the change in its rate of opening began at some load between 2500 pounds and 2750 pounds. Accordingly the rate of stretch with load on the tensile test specimen was predicted to change at a load between 7100 and 7800 pounds per square inch. From the test of the test specimen in tension, the change in the rate of stretch with load took place at 7500 pounds per square inch. Similarly for the second casting the prediction was made that the rate of stretch in the tensile stretch specimen would change at about 14,150 pounds per square inch as the change in the rate of opening with load in the frame casting began at about 5000 pounds. This change in the test specimen took place at about 13,750 pounds per square inch.

According to the well known beam formula advocated by Professor Jenkins, for casting No. 1, a tensile stress of 7500 pounds per square inch would have required a load of 4100 pounds; for casting No. 2, in order to reach a tensile stress of 13,750 pounds, a load of 7500 pounds would be required.

From these experiments Professor Rautenstrauch draws this conclusion: "Because of the results of these experiments, although few in number, and in view of the fact that Professor Jenkins' method of experimentation and analysis were not adapted to proving any theory of stress-strain relation, it is believed that the case against the Andrews and Pearsons' formula is not proven."

The final paper of this session was by C. K. Lassiter, in which he showed a method of finishing stay-bolts and the advantages of reducing at the center automatically during the threading operations. A comparison of costs for the different operations was also included in the paper. The paper did not provoke discussion.

The afternoon was given over to the enjoyment of the boardwalk and tea at the Country Club; the evening was devoted to the entertainment on the piers, for which tickets were furnished by the local committee.

Thursday Sessions

The papers of the morning were devoted to the work and interest of the gas-power section, and need mention here only by title: A Regenerator Cycle for Gas Engines Using Sub-adiabatic Expansion, by Prof. A. J. Firth; Gas Engines for Driving Alternating Current Generators, by H. G. Reist; Two Proposed Units of Power, by Prof. William T. Magruder; Operating Experiences with a Blast Furnace Gas Power Plant, by H. J. Freyn.

The first paper of the afternoon by H. L. Gantt showed some of the author's experiences in textile plants, described a bleachery machine for "piling" cloth, and expressed the opinion that there was a wide field for the mechanical engineer in developing machinery and mechanical processes for textile plants.

J. A. Capp, in a paper "The Elastic Limit of Manganese and Other Bronzes," showed the difficulty of determining the limit of proportionality in yellow metal specimens, advocated the use of autographic apparatus for this purpose and made a plea for better and more careful work in testing. This is the more necessary for with brasses and bronzes, the characteristic stress-strain curve is a smooth curve lacking the sudden drop so noticeable in curves from mild-steel specimens.

In the "Hydrostatic Chord," R. D. Johnson, of Niagara Falls, described a novel shape for large pressure conduits. This has been designed for large pipes with comparatively low water pressures, and lying in a shallow trench. The idea is to make the pipe of a shape that will tend to round with a mean pressure and lift both the dead weight of the pipe and the top fill, in order that the bending movements may offset each other and nearly a pure tension be secured.

"The Resistance of Freight Trains," by Prof. Edward C. Schmidt, of the University of Illinois showed the marked advantage of large capacity cars. Cars of 75 tons gross weight only required three pounds pull per ton at five miles per hour, while with a loaded car weighing fifteen tons, this ran up to 7½ pounds per ton. This proportion seemed to hold good at various speeds, although the required pull increased to 5½ and 13½ pounds per ton at 40 miles an hour.

It was also shown that the required pull per ton increased as the loads on a given car became less.

In the discussion, C. W. Baker pointed out the relation this bore to running machines at light load and to the designing of bearings to run at a low load per square inch. For, from the results obtained with cars, it was evident that the friction loss was less when the bearing was loaded to its full capacity.

Sanford B. Moss called attention to the fact that the film of oil which existed in all well lubricated bearings made the coefficient of friction independent of load.

The paper was freely discussed by F. J. Cole, W. F. M. Goss and others.

Honorary Membership Conferred upon Rear-admiral Melville

Just before the reception on Thursday evening, honorary membership was conferred upon Rear-admiral Melville, United States navy, retired. In a brief address President Westinghouse introduced the honored guest and presented the diploma. In a few well chosen words the admiral expressed his thanks for the appreciation thus shown to him.

His address was read by Walter B. MacFarland, and emphasized the duty that the engineer owes to the public in connection with public affairs.

Friday Morning Session

This opened with a paper by Henry Hess on "Ball-bearing Line-shaft Hangers." The paper gave in detail the relative and actual first cost of installation of a line shaft, with hangers, boxes, shaft, pulleys and belt to transmit 40 horsepower at 200 revolutions per minute for plain bearings and a similar shaft for ball bearings at 600 revolutions per minute. The latter shows a saving of $117.08, or 21 per cent., owing to the use of smaller pulleys and belts and an annual saving in power cost of $36.90.

Mr. Hess pointed out that it was possible, and probably advisable in many cases, to run even plain-bearing line shafts at a higher speed than was usually done, but that it would require much more care as well as power, when compared with ball-bearing equipment.

Frank B. Gilbreth inquired as to the effect of concrete buildings in maintaining alinement and suggested the appointment of a committee to investigate the methods of supporting shafting hangers in concrete buildings.

Chas. W. Baker asked regarding the effect of dust from concrete buildings, on the bearings. This brought out the method used by Mr. Hess for excluding dust and water, consisting of a shield or cap with square-lipped internal grooves that serve to keep the dirt out and the lubricant in. F. W. Dean suggested that one reason for shafting getting out of line was that hangers were only held against side motion by the friction of the hanger feet. He believed that larger hanger bolts would tend to prevent the belt pull from effecting them as badly as was now the case. He knew of one case where the line-shaft friction was 42 per cent., but gave the average for mill friction as 18 per cent.

Prof. W. T. Magruder, Columbus, O., gave a paper on "Experimental Analysis of a Friction Clutch Coupling." The tests made were to show the results from the application of a known force at the end of a shifter lever in a friction-clutch coupling. The relation between gradual application and picking up the load quickly is shown by the breaking of the clutch at 200 horsepower for the slow application and at 110 horsepower when the load was suddenly thrown on. Both of these took place at 100 revolutions per minute.

Tables were submitted showing the power required to throw the clutch into action under different conditions.

The discussion included Messrs. Vanderhof, H. D. and Oberlin Smith. The former believed that results should be expressed in terms of the load or mass started and the time required to accelerate it.

H. D. Smith, in answer to a question regarding gas engines, gave as his experience that allowance should be made according to the type of engine used. A single-cylinder gas engine should have a clutch of twice its rated horsepower; a double-acting or three-cylinder engine, a clutch of 1½ times the rated power, while for six-cylinder engines or other steadily running motors, a clutch of the rated capacity is all that is needed.

Oberlin Smith referred to the satisfactory use of the cone type of clutch when sufficient diameter could be secured to give a high speed and large bearing area. He had found a speed of about a mile a minute very satisfactory.

A paper by Prof. C. M. Garland on an improved absorption dynamometer was read in abstract in his absence. A type of eddy-current dynamometer was described, adapted for the absorption of power from motors under test, together with a statement of the conditions that such a dynamometer should fulfil and showing the advantages of this machine.

The dynamometer consists of a copper disk, revolving between the poles of an electromagnet. The absorbed power is utilized in the generation of eddy currents in the disk, producing heat that is carried off by the circulating water. Change in load is effected by a rheostat in series with the exciting coil.

The only discussion was from Prof. C. L. Allen, in which he stated that the Alden absorption dynamometer met practically all of the requirements laid down by Professor Garland. In a very able paper, S. H. Weaver discussed critical speeds for rotating bodies, and deduced 69 formulas for such speeds covering various special conditions of loading.

The nature of critical speed is thus explained: "All critical-speed calculations assume an unbalanced load. It is practically impossible to balance a rotating mass so that its center of gravity exactly coincides with the mechanical axis of

rotation. As the mass starts to rotate, the center of gravity will rotate in a very small radius around the shaft center. The rotation of the center of gravity at this small radius produces a centrifugal force which acts radially outward from the shaft center through the center of gravity and rotates around the shaft with the center of gravity." If a vertical shaft, with a concentrated load located with its center of gravity noncoincident with the axis of the shaft, be rotated, the shaft will bow in the direction of the load and rotate in that condition. The bowed shape will in itself increase the circle in which the center of gravity rotates; this increases the centrifugal force, and in turn the deflection. This action continues until finally a state of equilibrium is reached where the force of the shaft deflection is equal and opposite to the centrifugal force of the mass.

Above the critical speed the center of gravity revolves inside the bow of the shaft, or in a smaller circle than the shaft center; and the tendency of the rotating mass is to rotate about its own center of gravity, and not about the mechanical center. It approaches its center of gravity as a limit at infinite speed.

No satisfactory explanation has been given of the detail action at the critical speed, or of the manner in which the center of gravity passes from the outside to the inside of the bow of the shaft.

In machines where the normal running speed is higher than the critical speed, the shaft is made just strong enough to withstand the deflection in passing through critical speed, and as weak or flexible as possible for smooth running above the critical speed. The weaker the shaft, the lower the critical speed, the nearer approach to rotation about the center of gravity, and the less bow or deflection in the shaft.

The various conditions of support and loading of shaft were investigated mathematically, and formulas transformed for a number of special conditions presented in tabular form. These will be printed in a succeeding issue.

Classifying Casehardening

From a paper presented to the Iron and Steel Institute, dealing with the question of case-hardening, it is noted that it concludes that it is necessary to classify case-hardening compositions both by the carbon per cent. obtained in the "case," and also by the graduation of the carbon diffusion. This classification is necessary on account of one composition being more suitable for certain kinds of work than another. A high-carbon "case" such as 1.1 per cent. would be very efficient for the kind of work where the pressure was fairly constant, such as a plain bearing, but it would be very unsuitable and inefficient for parts which had to resist repeated shocks, because of the strong tendency of the high-carbon "case" to chip or even to peel off. Consequently, it is advisable, where all kinds of case-hardening have to be done, that two compositions be used—one of them to produce a high-carbon "wearing surface," and the other to produce a medium-carbon "wearing surface." On the other hand, for a composition to be used for "general" purposes, it should produce a "wearing surface" containing a percentage of carbon equal to that of the eutectoid 0.9 per cent., in order to give the most efficient results.

Another use for aluminum has been found in combining it with gold to produce a metal that is said to possess a beautiful hue adaptable for wide use in the jewelry trade. The alloy is composed of about 78 per cent. gold and the aluminum seems to give just about enough different color to give a very artistic appearance.

Increasing Shop Capacities

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

Ringling Brothers will double its car shops at Baraboo, Wis.

The Victoria Mills, Thornton, R. I., will build an addition.

The Esmond (R. I.) Mills will install additional equipment.

The village of Croghan, N. Y., is to build a waterworks system.

The Lucas Pump Company, Dayton, Ohio, will enlarge its plant.

The London (Ont.) Bolt and Hinge Works will enlarge its plant.

J. Beel, Bellewood, Wis., will remove his sawmill to Ashland, Wis.

W. W. Crawford, Fairbault, Minn., will erect a blacksmith shop.

Green, Miller & May, Mahnomen, Minn., will improve its flour mills.

The plant of the Appleton (Wis.) Water Works will be reconstructed.

The Waterous Engine Works, Brantford, Ont., will build an addition.

The citizens of Rippey, Iowa, voted to issue $7000 bonds for waterworks.

Baird & Collins, Peotone, Ill., is erecting a cement, brick and tile factory.

A modern laundry building is to be erected at the city prison, Atlanta, Ga.

The Columbiana (Ohio) Pump Company will erect a new machine shop.

The Milwaukee (Wis.) Bronze Casting Company is to enlarge its plant.

The Crescent Milling Company, Fairfax, Minn., will erect a power house.

The city council, Twisp, Wash., is taking steps for a muncipal water plant.

The Woonsocket (R. I.) Machine and Press Company is erecting an addition.

The foundry of Reid & Brown, Toronto, Ont., was badly damaged by fire.

Frank Klink, of Gilbert, Minn., will erect a sawmill at Pelican Rapids, Minn.

The city of Leicester, Mass., will shortly call for bids for new water system.

The Anderson Forge Company, Detroit, Mich., is now putting up an addition.

Explosion wrecked O'Neil's planing mill at Kenilworth, Ont., causing $20,000 loss.

The Parsons (W. Va.) Pulp and Paper Company is to build another paper mill.

Holland & Holland, Fresno, Cal., will build a new creamery and ice-cream factory.

Wilson Brothers, South Bend, Ind., will build an addition to their shirt factory.

The Edna Smelting Works, Cincinnati, O., is to erect a new $100,000 brick building.

The E. H. H. Smith Silver Company, Bridgeport, Conn., is building an addition.

The Patterson Automobile Company will erect a $50,000 plant at London, Canada.

The planing mill of J. A. Desrivieres, at Ottawa, Ont., was burned. Loss, $30,000.

The plant of the Kinistino (Sask.) Milling Company, destroyed by fire, will be rebuilt.

The Canadian Northern Railway will erect large car shops at New Westminster, B. C.

The plant of the Niagara Spray Company, at Burt, N. Y., was burned. Loss, $10,000.

Dement Brothers, Walla Walla, Wash., will erect a flour mill near Underwood, Wash.

The Seattle (Wash.) Taxicab Company will erect a three-story garage to cost $30,000.

The Grand Rapids (Mich.) Cigar Box Company will build a new three-story factory.

The plant of the Monarch Oil Company, Bakersfield, Cal., was burned. Loss, $260,000.

The citizens of Philip, S. D., will vote on $13,000 bond issue for municipal waterworks.

The Waltham Piano Company, Milwaukee, Wis., will erect a $60,000 factory building.

The Fargo Creamery Supply Company, Lake Mills, Wis., will erect additions to its plant.

The H. Knapp Implement Company, Decatur, Ind., will erect a new three-story plant.

The Independent Stove Company, Owosso, Mich., is erecting several additional buildings.

Fifteen thousand dollars will be spent in improving the electric-light plant at Ingersoll, Ont.

The Oklahoma Grain Dealers Association will build a $200,000 elevator at Oklahoma City.

The National Carbon Company will erect a $50,000 addition to its plant at Fremont, Ohio.

The J. M. Danelz Mercantile Company will build a $30,000 flour mill at Red Cliffe, Alberta.

The International Harvester Company will add three new buildings to the Auburn, N. Y., plant.

The Burlington (N. J.) Electric Light and Power Company will build a new power plant.

The Wiegel Candy Company, Tacoma, Wash., has let contract for a four-story addition.

The American Electric Fuse Company, Muskegon, Mich., will build a $12,000 addition.

The Norfolk & Western Railroad is considering the erection of repair shops at Eckman, W. Va.

The Tips Foundry and Machine Company, Austin, Tex., will rebuild its shop recently burned.

The Wakefield (R. I.) Manufacturing Company, making woolens, will install new machinery.

The Heney School Furniture Company, Grand Rapids, Mich., is to build a new foundry.

The Alabastine Company, of Paris, is erecting a new mill at Caledonia, Ont., to cost $50,000.

Fire destroyed the plant of the Standard Brick Company, at Empire, Ohio. Loss, $25,000.

The power plant of the Wilmington (Del.) City Electric Company was destroyed by lightning.

Fire practically destroyed the molding room of the Ypsilanti (Mich.) Hay Press Company.

The sawmill of T. A. Burrows, at Grandview, Man., Canada, was burned. Loss, $100,000.

The plant of the New Jersey Oil and Meal Company, at Jersey City was burned. Loss, $100,000.

The city of Bryan, Tex., will build a water, light and sewage plant to cost about $100,000.

The Atlantic Screw Company, Hartford, Conn., is to spend about $40,000 in enlarging its plant.

The Brunner (Texas) Light and Water Plant is about to erect a new light and pumping plant.

The Standard Foundry Company, Racine, Wis., is building an addition to be used as core room.

The Cartercar Company, Pontiac, Mich., contemplates a large extension to its automobile plant.

The city of East Alton, Ill., is planning a municipal waterworks and will vote on $7000 bond issue.

The Strong-Hewat Company is to erect a large addition to its woolen mill in Briggsville, Mass.

The Farmers Grain and Milling Company will erect a 100-barrel flour mill at Mayville, N. D.

The York (Penn.) Manufacturing Company is building an addition to be used as a boiler shop.

C. P. Shaw, Natchez, Miss., is contemplating making some extensive improvements in his foundry.

The National Gauge and Register Company, of Minneapolis, Minn., will locate at La Crosse, Wis.

The United Shoe Machinery Company, of Boston, will build large factories at Maisonneuve, Que.

The Riggi Candy Company, 1104 Woodland street, Cleveland, Ohio, is looking for a factory building.

The Batesville (Miss.) Manufacturing Company is to establish a spoke factory at Newton, Miss.

George W. Swift, Bordentown, N. J., machinery manufacturer, is to build an addition to its plant.

The Alta (Iowa) Traction and Light Company will build a machine shop; also 80-foot smoke stack.

The Warren Iron Works Company, of Crookston, Minn., and others, will erect a $7000 garage.

The Walker Electric Company, Philadelphia, Penn., is having an addition built to cost $10,000.

The Eagle Roller Mill Company, New Ulm, Minn., will erect a five-story mill to cost $100,000.

The box factory of Bradley, Miller & Co., Bay City, Mich., was destroyed by fire. Loss, about $20,000.

The Shaw Electric Company, Red Bank, N. J., is erecting a new power plant to cost about $75,000.

The planing mill of Hall Bros. & Wood, Philadelphia, Penn., was destroyed by fire. Loss, $75,000.

Fire destroyed the plant of the Maury County Cereal Company, Columbia, Tenn. Loss, $12,000.

The Baltimore (Md.) Belting Company has awarded contract for the erection of a five-story addition.

The sawmill of the Wright Lumber Company, at Merrill, Wis., was destroyed by fire. Loss, $100,000.

The mill of the Blumauer Lumber Company, Tenino, Wash., was destroyed by fire. Loss, $100,000.

The McBeth-Evans Glass Company, Elwood, Ind., is erecting an addition to be devoted to pot making.

The Rippe Grain and Milling Company, of Fairmont, Minn., will erect a flour mill at Bowman, N. D.

The Hartley Silk Mill Company, of New York, will construct a large silk mill at Waverly, N. Y.

The grain elevator and warehouse of John W. Eshelman, at Lancaster, Penn., was destroyed by fire.

The Cummins Ice and Cold Storage Company, a new concern, is to erect a plant at Ottumwa, Iowa.

The city of Crawfordsville, Ind., has voted to build a new municipal electric-light plant to cost $85,000.

The plant of the Standard Brick Company, Empire, Ohio, was burned. Loss, $25,000. Will be rebuilt.

The Stroh Die Moulded Casting Company, Milwaukee, Wis., is erecting a seven-story factory building.

The mills of the Sleepy Eye (Minn.) Milling Company will be overhauled and improvements made.

The Naperville (Ill.) Lounge Company is looking for a site on which to erect a new and larger plant.

The Southern Motor Car Company, Jackson, Tenn., is looking for a site for a new and larger plant.

A. A. Barthelmes & Co., Toronto, Ont., manufacturing piano actions, will erect a new five-story factory.

The Water Committee, Kewanee, Ill., is considering the question of equipping new waterworks plant.

The National Brake and Electric Company, Milwaukee, Wis., will build a $50,000 addition to its plant.

The Seitz Motor Company, Detroit, Mich., recently formed, is looking for site for an automobile factory.

Bids have been asked by Follansbee Bros. for erecting two hot mills at its plant at Follansbee, W. Va.

Cataletts Grist Mill, Fairmont, Ill., is in the market for engine and boiler. Arthur Shanks is engineer.

The roundhouse of the Iowa Central Railroad at Marshalltown, Iowa, is to be improved and enlarged.

Bids will be received until June 23 for two 350-horsepower boilers at the Columbus (Ohio) State Hospital.

The citizens of Tyndall, S. D., voted to expend $16,000 for the installation of a municipal electric-light plant.

R. Green & Co., shipbuilders, Chelsea, Mass., is looking for suitable site on which to erect a modern plant.

The Spring Valley (Minn.) Electric Light and Investment Company will make extensive repairs to its plant.

The Burlington (Vt.) Light and Power Company will erect a new 1000-kilowatt steam turbine power plant.

The National Fireproofing Company, of Pittsburg, Penn., is to erect a $1,000,000 plant at Hamilton, Canada.

The Pennsylvania Railroad is to build a $50,000 planing mill on the Hackensack Meadows, Jersey City, N. J.

The American Hard Rubber Company is preparing to make more additions to its plant at College Point, L. I., N. Y.

M. O. Claussen, engineer, St. Paul, Minn., will prepare plans for waterworks and electric plant for Brainerd, Minn.

The Philadelphia (Penn.) Electric Company will build an auxiliary power plant at Twentieth and Market streets.

The Maritime Cold Storage Company will erect a five-story cold-storage plant at Lockeport, N. S.; also glue factory.

The Geyser Oil Tank Company, Fort Wayne, Ind., is planning to erect a new factory to employ about 300 men.

The plant of the Hooker Electro-Chemical Company, Niagara Falls, N. Y., was destroyed by fire. Loss, $400,000.

The plant of the Selkirk Match Company, at Selkirk, Manitoba, destroyed by fire, will be rebuilt and greatly enlarged.

Plans have been filed by the New York Central Railroad for a large addition to its car shops at East Buffalo, N. Y.

The Kingsbury Footwear Company, Montreal, Canada, will double its plant and install a lot of modern machinery.

Fire destroyed the Blacklock Foundry, South Pittsburg, Tenn. Sad irons, sinks, hollow ware, were manufactured.

It is understood that the Eagle Knitting Mills Company, of Dalton, Ga., is planning to rebuild a plant recently burned.

The American Velvet Company, Stonington, Conn., expect to install new machinery soon to take care of increased business.

The core shop at the new plant of the Detroit Valve and Fittings Company, at Wyandotte, Mich., was destroyed by fire.

The Grabowsky Power Wagon Company, Detroit, Mich., has started the erection of a new factory to be four stories high.

The Woodcock Manufacturing Company, of Litchfield, Ill., is looking for a site on which to erect a foundry and machine shop.

The planing mill of the Great Southern Lumber Company, at Bogalusa, La., was destroyed by fire. Loss, about $199,000.

The car barns and repair shops of the Des Moines (Iowa) Street Railway Company were destroyed by fire. Loss, $140,000.

The Ramsey-Alton Manufacturing Company, Portland, Mich., is erecting an addition to be used for manufacturing automobile bodies.

Mariatt & Clark Company, Fort Atkinson, Wis., will erect a plant in Winnipeg, Man., for the manufacture of creamery machinery.

The Miller Company, London, Ont., a concern capitalized at $70,000, will establish a plant for the manufacture of brass specialties.

Fire damaged the plant of J. Ballantine & Co., Preston, Ont., to the amount of $60,000. The concern builds woodworking machinery.

The Macey Company, Grand Rapids, Mich., manufacturing office and library furniture, is erecting a four-story addition to its plant.

The Chippewa Sugar Company, Chippewa Falls, Wis., is contemplating erecting a factory for manufacturing paper from beet pulp.

The D. J. Murray Manufacturing Company, Wausau, Wis., is building a new machine room. The company builds sawmill machinery.

The Waukegan (Ill.) Commercial Association is to discuss the establishment of a new automobile factory controlled by Waukegan men.

Fire in the shops of the Bessemer Railroad, at Greenville, Penn., destroyed temporary roundhouse and a number of smaller buildings.

The Burroughs Adding Machine Company, Detroit, Mich., is building an addition to its factory to have a floor space of 78,325 square feet.

French & Hecht, Davenport, Iowa, have started the construction of a foundry in connection with new wagon works now being built.

J. H. Whitehead Company, of Chicago, Ill., will establish a branch of its machinists, mill and railway-supply house, at Waterloo, Iowa.

The Eastern Canadian Steel and Iron Works, Ltd., has secured a large tract of land at Quebec, Canada, and will erect a plant.

The Gaylord (Mich.) Motor Company, recently organized to manufacture automobiles, is having plans made for the erection of a plant.

The Dunlap Engineering Company, Columbus, Ohio, formerly the Columbus Pneumatic Tool Company, is erecting an addition to its plant.

The McKeen Motor Company, Omaha, Neb., has commenced work on extension to its plant, which will greatly increase its capacity.

The plant of the Washburn (Wis.) Brick Company has been leased by T. J. Skjelberg, of Rice Lake, Wis. New machinery will be added.

The Pribnow Swage and Tool Works, Mellen, Wis., will increase the capacity of its plant and will need drills, planer, miller, lathe.

The Standard Wall Paper Company, Schuylerville, N. Y., has broken ground for the erection of a new coloring plant to employ 100 hands.

The Shiman-Miller Manufacturing Company, Newark, N. J., manufacturing diamond mountings and jewelry, will erect a five-story addition.

The Norrisburg (Ont.) Tack Manufacturing Company, which is to erect a tack factory, will also build a plant for the manufacture of nails.

The Milwaukee (Wis.) Electric Railway and Light Company will build a car-building and repairing and storing plant to cost $500,000.

Post Van Der Burg & Co., Rotterdam, Holland, buyers of all kinds of machinery and tools, would like to receive catalogs with best terms.

Fire caused $10,000 damage to the plant of the Richardson Manufacturing Company, Worcester, Mass., manufacturing agricultural implements.

The A. O. Smith Company, Milwaukee, Wis., will shortly build a large plant in connection with a new plant for the manufacture of automobiles.

Dr. Aldolph Luria, 26 Fowler street, Chicago, Ill., representing a hospital-bed company, is trying to secure site on which to erect a plant.

The Minneapolis (Minn.) Steel and Machinery Company is contemplating the erection of a new plate mill for the handling of bridge girders.

The American Smelting and Refining Company, with general offices at 165 Broadway, New York, will build a $1,000,000 plant in Springfield, Ill.

The Eastern Machine Screw Company, recently incorporated with M. Walter Garde, of Hartford, Conn., as president, has acquired site for a plant.

The Wilkes-Barre (Penn.) Lace Company is planning to erect an addition to cost $500,000, which will give employment to 1000 more hands.

The Stockwell-Haley Company, Los Angeles, Cal., manufacturing bedding and upholstery, is having plans prepared for a new four-story factory.

One of the main buildings of the Hooker Electric Chemical Company, Niagara Falls, N. Y., was destroyed by fire, causing a loss of about $100,000.

The Western Steel Corporation is having plans drawn for enlargement of its plant at Irondale, Seattle, Wash., including a new open-hearth furnace.

The South Western Traction Company, with head offices at London, Ont., is to make extensions and will be in the market for supplies and equipment.

The Clayton & Lambert Manufacturing Company, Detroit, Mich., manufacturing gasolene furnaces, plumbers' and tinners' tools, is erecting an addition.

Fred Bredel, 405 Keene street, Milwaukee, Wis., builder of gas plants, is making investigation toward securing desirable site on which to erect a plant.

The Acme Tiling and Concrete Company, Paragould, Ark., capitalized at $25,000, will establish a plant for the manufacture of tiling and concrete blocks.

The planing mill and lumber yard of the Harrison County Lumber Company, at Marshall, Tex., were destroyed by fire, causing a loss of about $30,000.

Fire destroyed $30,000 worth of machinery and patterns at the plant of the Malleable Iron Company, at Amherst, Nova Scotia. Will be replaced immediately.

Proposals will be received by Major M. Gray Zalinski, Army building, New York, until 2 p.m., June 20, for ice and refrigerating plant for Corregidor, P. I.

The Los Angeles (Cal.) Gas and Electric Company will erect an addition to its electric generating station and boiler room at Eleventh and Alameda streets.

The Champion Company, of Boston, manufacturing spark plugs for automobiles, will establish a factory at Toledo, Ohio, in the Snowflake Laundry building.

The Union Tanning Company, successor to the United States Leather Company, is to rebuild its plant at Petersburg, W. Va., destroyed by fire some years ago.

Sealed proposals will be received by the commanding officer, Frankford Arsenal, Philadelphia, Penn., until June 27, for one spherometer as per Circular No. 253.

The Canadian Pacific Railroad is said to be interested in a new $1,000,000 shipbuilding and repairing plant to be erected on its grounds at Owen Sound, Canada.

The Morris Manufacturing Company, Little Rock, Ark., capitalized at $25,000, is to build a plant for the manufacture of sawmill machinery patented by T. C. Morris.

The Gage County Gas, Light and Power Company, it is said, will build a $90,000 plant at Beatrice, Neb., to be run by water, but also equipped with gas engine.

Contract has been awarded to Fred T. Ley & Co., Springfield, Mass., by the Connecticut Company for the erection of a power house in Waterbury, Conn., to cost $100,000.

The Liberty Incandescent Lamp Manufacturing Company, Chatham square, N. Y., has purchased site at Ozone Park, and is having plans drawn for a five-story factory.

The Chicago & Northwestern Railroad has issued a new list of tools required, including lathes, crank shapers, planers, slotters, drill presses, boring mill, grinders, bolt cutters, etc.

The Standard Metal Manufacturing Company, of Chicago, has secured contracts from the "Soo" line for engine castings and will probably locate a foundry at Fond du Lac, Wis.

Permit has been secured for the erection of a four-story boiler house at Forty-ninth street and Lexington avenue, New York, for the New York Central and Hudson River Rail road.

The International Cement Company has awarded contract to the Freeborn Engineering Company, of Kansas City, for the erection of a $1,000,000 cement plant at Juarez, Mexico.

The Goold, Shapley & Muir Company, Brantford, Canada, is rebuilding a portion of plant which burned some time ago. The company manufactures gasolene engines and steel windmills.

The American Stone Company, St. Louis, Mo., is preparing to erect a new plant to cost about $400,000. This is to consist of machine shops, brass foundry, enameling room, nickel-plating room, etc.

The Northern Pacific Railway Company has taken out building permit for the erection at Marshall street and Thirty-seventh avenue, Minneapolis, Minn., roundhouse, coal dock, engine room, machine shop, etc.

Mokand Lab, inspector of works, Northwestern Railway, Gujranwala, Panjab, India, would like catalogs, etc., on complete equipment of plant for the manufacture of copper and brass kitchen and household utensils.

The Thos. B. Jeffrey Company, Kenosha, Wis., is to start soon on several additions, including power house, machine shop, assembling shop, inspecting shop. Some of the equipment needed has been contracted for.

It is reported that the Herendeen Manufacturing Company, of Geneva, N. Y., recently merged with the U. S. Radiator Company, is looking for a suitable site on which to erect a larger plant and may move to another locality.

J. Wahlman & Son, Negaunee, Mich., has been awarded contract for the erection of a

power house at the Smith mine; also crusher and ore-sampling house at the Austin mine, both operated by the Cleveland-Cliffs Iron Company.

The Hamilton (Ohio) Motor Car Company, capitalized at $50,000, will establish a plant at Greensburg to manufacture motor car designed by Harry W. Hamilton. C. P. Corbett, Walter W. Bonner, H. T. Wordfil are interested.

The St. Clair Gas and Electric Company, East St. Louis, Ill., has completed plans for a new plant to cost about $225,000. Permits have been obtained for two buildings, one to be engine room and the other a water-gas house.

Proposals will be received until 3 p.m., June 20, at the office of supervising architect, Treasury Department, Washington, D. C., for one high-pressure steam water-tube boiler for United States post office, court house, etc., at Baltimore.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 20, for manganese shells for revolving screens for rock-crushing plant, steel castings, fixebox steel, crucibles, hose couplings, as per Circular No. 587.

The Westinghouse, Church, Kerr Company, 10 Bridge street, New York, is investigating throughout the Middle Atlantic section with a view toward securing suitable site on which to erect a plant for the manufacture of iron castings which will employ 1000 men.

The Western Dry Dock and Shipbuilding Company is erecting a $1,250,000 dry-dock and shipbuilding plant at Port Arthur, Ont., which will entail a large amount of machinery, as there will be a complete boiler shop, rolling and punching shops, pattern shop and foundry. James Whalen, of Port Arthur, is president.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 21, for air-brake hose, rubber belting, packing, gaskets, copper tubing, bolts, rail benders, saws, diaphragm pumps, water gages, hose couplings, flue cleaners, steel tapes, etc., as per Circular No. 588.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 14 for one motor driven radial drill (schedule 2550), one motor driven radial drill (schedule 2552), furnishing and installing miscellaneous machine tools, including oxy-acetylene welding and cutting plant (schedule 2547).

Charles H. Blanchard, formerly of the Blanchard-Watson Company, Leominster, Mass., making pins, combs, etc., has associated himself with Fred C. England, of Worcester, and others, and formed a company to be known as Blanchard, England & Co. Plant will be erected in Leominster for the manufacture of combs and employ about 200 hands.

Sealed proposals will be received at the office of constructing quartermaster, Military prison, Fort Leavenworth, Kan., up to 10:30 a.m., June 30, for 85 tons soil pipe and fittings, 1600 brass cocks, 795 nonsiphoning basin traps, 10,000 feet wrought-iron pipe with fittings. Information can be had of Major Thomas H. Slavens, constructing quartermaster.

A meeting was held in the Commercial Club room, Johnson City, Tenn., for the purpose of considering the matter of taking stock in a down-draft smokeless-boiler plant, which is to be run in conjunction with the Johnson City Foundry Machine Works. A building is to be erected at a cost of about $8000, and $18,000 of machinery will be added to enable the foundry and machine works to manufacture the down-draft boilers.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 28—4400 feet leather belting, twist drills (schedule 2569), centrifugal pumps (schedule 2466), 100 tons pig iron, 6000 pounds billet steel, 94,100 pounds medium steel (schedule 2572), eight sensitive bench drills, No. 4 milling machine, vertical, motor driven (schedule 2551), No. 5 milling machine, univelsal, motor driven (schedule 2551).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: June 14—Four canvas belts (schedule 2563), five steam-jacketed copper kettles (schedule 2556), nine blacksmiths' anvils, 39,000 pounds bolts and nuts, 10 mounted grindstones, 480 hammers, hand tools (schedule 2561), 57,000 pounds machinery steel (schedule 2574), 3500 pounds rod steel (schedule 2560), 5250 pounds tool steel (schedule 2564), motor-generator set (schedule 2557).

New Incorporations

Stanley Shoe Company, Boston, Mass. Manufacture boots and shoes. Capital, $30,000. A. Caunt, Lynn, president.

Trebest Gas Engine Company, Butler, Ind. Capital, $20,000. Directors, H. M. Showalter, D. A. Baker, Frank Creager, etc.

Bretton Hill Garage Company, New York. Garage. Capital, $50,000. Incorporators, M. A. Cramer, S. Meyer, J. Fischer.

C. & L. Manufacturing Company, Chelsea, Mass. Manufacture and sell machinery. Capital, $50,000. K. G. List, president; W. M. Conrad, treasurer.

T. M. & A. Motor Company, Portland, Me. Manufacture and deal in engines, pumps, etc. Capital, $1,000,000. W. E. Pearson, Swampscott, Mass., president.

Junkers-Burdick Company, Chicago, Ill. Manufacture automobiles and accessories. Capital, $25,000. Incorporators, O. Junkers, W. Burdick, G. J. Meier.

Automatic Arms Company, Buffalo, N. Y. Manufacture automatic guns. Capital, $100,000. Directors, George R. Klahs, Fred W. Ely, Jas. E. McAlpine, etc.

Maddock Textile Company, Milford Center, Ohio. Manufacture textile goods. Capital, $25,000. Incorporators, A. Boylan, John Richter, A. F. Robinson, etc.

West Jersey Bag Company, Camden, N. J. Manufacture bags. Capital, $30,000. Incorporators, A. M. Bates, Chicago, Ill.; J. Chalmers, T. E. French, Camden.

Rayfield Motor Car Company, Springfield, Ill. Manufacture automobiles and accessories. Capital, $150,000. Incorporators, J. F. Miller, E. E. Staley, B. Vancil.

Rock Island Pulverizer Company, Rock Island, Ill. Manufacture mining and milling machinery. Capital, $100,000. Incorporators, Robert Forsythe, W. W. Wiegand, etc.

Stillman Safety Lamp Company, New York. Manufacture safety lamps and apparatus for same. Capital, $200,000. Incorporators, J. W. Potter, V. M. Bovic, F. P. Wilson.

Johnstown Clay Manufacturing Company, Johnstown, Ohio. Manufacture brick, cement, etc. Capital, $20,000. Incorporators, Friend Butt, H. J. Butt, Harry Butt, etc.

Gulf State Portland Cement Company, Cleveland, Ohio. Manufacture cement, etc. Capital, $10,000. Incorporators, W. B. Whitney, F. M. Kirby, J. Walworth Sutphen, etc.

O. O. Poorman Company, New Bremen, Ohio. Manufacture and sell sheet metals, machinery, etc. Capital, $30,000. Incorporators, Oscar O. Poorman, E. F. Ziegerfelder, etc.

Campus Auto Garage, Rochester, N. Y. Manufacture and deal in automobiles, cycles, supplies. Capital, $10,000. Incorporators, Eugene A. Stein, James Barry, Henry B. Shield.

Mount Holly Garage, Northampton township, Burlington county, N. J. Automobile garage. Capital, $100,000. Incorporators, W. T. Stewart, Ellis H. Parker, W. Roland Warwick.

Shaw-Morillat Company, Chicago, Ill. Manufacture and deal in motor vehicles and appliances. Capital, $10,000. Incorporators, Howard I. Shaw, E. Raymond Bliss, Jr., Lloyd Morillat.

National Aviation and Construction Company, Boston, Mass. Manufacture aëroplanes and balloons. Capital, $50,000. E. Burlingame, Boston, president; T. McCall, Dorchester, treasurer.

Napolean Lumber and Handle Company, Napolean, Ohio. Manufacture lumber timbers and handles. Capital, $10,000. Incorporators, Chas. F. Ferguson, M. H. Ferguson, John Douty, etc.

Sanitary Glass Facing and Brick Company, Columbus, Ohio. Manufacture patented glass facing and faced bricks. Capital, $50,000. Incorporators, H. C. Ensign, C. H. Boardman, F. K. Young, etc.

Baldwin Motor Service Company, Hackensack, N. J. Manufacture and deal in automobiles. Capital, $250,000. Incorporators, T. H. Baldwin, Hackensack; F. Kaegebehn, Brooklyn, N. Y., etc.

Dixon Motor Car Company, Buffalo, N. Y. Manufacture and deal in automobiles, etc. Capital, $15,000. Incorporators, John C. Dixon, 408 Potomac avenue; R. A. Myers, 1008 Main street, etc.

McMann & Taylor Company, New York. Manufacture and deal in iron pipe, boiler tubes, radiators, valves, etc. Capital, $400,000. Incorporators, G. N. K. Taylor, J. R. McMann, G. E. Benford.

Slater, Marsden & Whittemore Company, Rockton, Ill. Machine shop and foundry. Capital, $20,000. Incorporators, Geo. B. Slater, Geo. W. E. Marsden, Henry Whittemore, S. A. Hyer, Rockford, Ill.

Universal Standard Electric Company, Brooklyn, N. Y. Manufacture and deal in all kinds of electrical machinery and supplies. Capital, $50,000. Incorporators, J. J. Nevins, W. H. Hobart, A. Schreiber, Brooklyn.

Horseshoe Auto Tire Company, New York. Manufacture and deal in automobiles and supplies, tires for all kinds of vehicles. Capital, $25,000. Incorporators, U. E. Holloway, 249 East One Hundred and Twenty-third street; Wm. Huber, 110 Worth street, etc.

Inter-Eastern Paper Box and Machine Company, New York. Manufacture and deal in machinery and supplies for manufacturing paper boxes, etc. Capital, $200,000. Incorporators, Melvin C. Miller, Toledo, O.; Andrew J. Selz, Joseph E. Carr, New Rochelle, N. Y.

BUSINESS ITEMS

The Reliance Electric and Engineering Company, Cleveland, Ohio, announces that hereafter its armature-shifting type of variable-speed motor will be known as the Reliance adjustable-speed motor instead of the Lincoln variable-speed motor as formerly.

The newly organized Grant & Wood Manufacturing Company, of Detroit, and Chelsea, Mich., announces that in addition to its extensive operations in the manufacture of automatic multiple spindle screw machines and screw-machine products, it will also engage in the manufacture of high-grade balls for bearings. The Grant & Wood Manufacturing Company has acquired all rights and patents,

both American and foreign, on Jno. J. Grant's machines and processes and is equipping its Chelsea plant for the extensive production of a superior quality of balls. The new machines are now being built and the company expects to have its product on the market some time during the coming season. This company recently purchased outright and consolidated the properties of the Grant Automatic Machine Company, of Cleveland, Ohio, and the Chelsea Stove and Manufacturing Company, of Chelsea, Mich. The plant of the latter company, which is a very large and modern one, is now being extensively equipped with new and modern machinery. The officers of the company are: President and general sales manager, Eben B. Boye, formerly sales manager of the Warner & Swasey Company, Cleveland, Ohio; vice-president, Arthur O. Smith, president of the A. O. Smith Company, of Milwaukee, Wis.; secretary and treasurer, Harry L. Stanton, formerly manager of the Chelsea Stove and Manufacturing Company, Chelsea, Mich.; factory manager, Erwin E. Wood, formerly president and general manager of the Walcott & Wood Machine Tool Company, Jackson, Mich. The directors are: Dr. J. B. Book, a well known Detroit capitalist; John T. Shaw, president of the First National Bank; William T. Barbour, president of the Detroit Stove Works; Walter E. Flanders, president of the E-M-F Company, and Robert M. Brownson, attorney.

TRADE CATALOGS

Union Manufacturing Company, New Britain, Conn. Catalog. Chucks. Illustrated, 64 pages, 4x7 inches, paper.

Ingersoll-Rand Company, 11 Broadway, New York. Form No. 3017. Gas compressors. Illustrated, 32 pages, 6x9 inches.

Pawling & Harnischfeger Company, Milwaukee, Wis. Bulletin No. 18. Traveling electric cranes. Illustrated, 28 pages, 7x10½ inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 125. Class I self-contained recording thermometers. Illustrated, 12 pages, 8½x10½ inches.

The Grant Nail and Supply Company, 47 High street, Boston, Mass. Catalog. Turney adjustable machine reamers. Illustrated, 10 pages, 3½x6 inches, paper.

Sprague Electric Company, 527 West Thirty-fourth street, New York. Booklet No. 233. Electric hoists. Illustrated, 24 pages, 4x9 inches. Booklet No. 516. Flexible steel armored hose. Illustrated, 28 pages, 4x9 inches. Catalog No. 321. Electric fans. Illustrated, 36 pages, 8x10½ inches.

FORTHCOMING MEETINGS

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANT ADVERTISEMENTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 930 G St., Washington, D. C. Write for Inventor's Handbook.

Light, fine machinery and mechanical specialties built to order; jigs, tools, etc., designed and built. Goodson Electric and Manufacturing Co., Providence, R. I.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

We are about to complete a large contract and are, therefore, in a position to take up the manufacture of fine instruments, parts for the same, dies and jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—Foreman for brass finishing department in large electrical factory. Apply, stating experience, Canadian General Electric Co., Peterboro, Ontario.

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Peterboro, Ont.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—Salesmen to handle on a generous commission basis, a well advertising and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," AMERICAN MACHINIST.

ILLINOIS

Wanted—Gas engine expert to take charge of final test, inspection and checking out department of a large gas engine factory; none but competent men need apply. Box 572, AMERICAN MACHINIST.

IOWA

Wanted—Thoroughly competent machinist and designer to act as foreman in growing manufacturing concern; one who has inventive ideas and can apply them to a machine now being put on the market; must be able to handle men to get best results and keep down cost of production; we have a good opening for a wide-awake, uptodate man; give reference, experience, age and wages wanted. Box 594, AMERICAN MACHINIT.

MASSACHUSETTS

Wanted—Toolmakers, experienced on punch and die work. Apply Employment Department, General Electric Co., Pittsfield, Mass.

Wanted—Near Boston, gear inspector, stock room clerk, tool room clerk, case-hardening expert, day and night machinists and gear cutters. Box 606, AMERICAN MACHINIST.

Wanted—Mechanical draftsman experienced on machine tools, jigs, etc., to work in drafting department of large machine shop; steady employment for right party. Fore River Shipbuilding Co., Quincy, Mass.

MICHIGAN

Wanted—A few first-class toolmakers experienced on die, jig and fixture work for light manufacturing. Box 592, AM. MACH.

Wanted—A manager with a few thousand dollars to take charge of a manufacturing plant, located in central Michigan. Box 563, AMERICAN MACHINIST.

Wanted—Immediately, first-class metal patternmakers, tool and jig makers; give reference and experience; steady work. Holm's Machine Mfg. Co., Sparta, Mich.

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Drop forge superintendent who can show a successful record for at least five years can obtain position with large company in Michigan, who will pay good salary to the man who can produce results; the man must be able to design dies, plan equipment, direct die and forge room foreman and build up first-class organization. In reply give references, age and salary expected. Box 540, AMERICAN MACHINIST.

MISSOURI

Wanted—Chief draftsman with technical engineering training, with machine shop and foundry experience, able to produce economical results. Curtis & Co. Mfg. Co., St. Louis,

Wanted—Chief inspector; one familiar with steel bolsters and car work by large steel plant in West; one with car building experience preferred; give references and experience. Box 576, AMERICAN MACHINIST.

NEW JERSEY

Wanted—First-class water meter general foreman accustomed to precision work; state terms and previous experience. Box 543, AMERICAN MACHINIST.

Wanted—First-class water meter engineer having had experience in designing and manufacturing; state requirements, age and previous experience. Box 542, AMER. MACH.

Wanted—Working foreman wood pattern maker, one who can figure on work and has executive ability; to the right man good wages and steady work will be given; give age, experience, etc. Box 564, AMER. MACH.

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia.)

NEW YORK

Wanted—Planer hands, floor repair hand, lathe hands. Address P. O. Box 761, North Tonawanda, N. Y.

Wanted—Foreman for tool department and tool makers; state qualifications and rate wanted in first letter. The Kirkham Motor Mfg. Co., Bath, N. Y.

Wanted—Two floor inspectors in machine shop manufacturing automobile parts; do not apply unless you have held a similar position. Address Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

All-around machinists, including lathe, drill, planer, milling machine and vise hands, can obtain steady employment by applying to Brooks Works of the American Locomotive Company, Dunkirk, N. Y.

Wanted—Thirty machine shops in Rochester, N. Y., wants first-class machinists for steady positions; to efficient men wages $16.50 to $21 per week and 9 hours per day; open shop. Write P. O. Box 252, Rochester, N. Y.

Superintendent wanted for Eastern printing press factory; must have ability to handle men without friction, increase production, and reduce cost. Apply stating fully, nationality, age, experience, references and salary expected. Box 598, AMERICAN MACHINIST.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Foreman for tool room; must be an all-around mechanic, particularly an expert on die work and capable of producing results in this line; age to be 30 to 45 years; wages wanted must be given, as well as a detailed account of previous experience. In order to receive consideration; references or copies of references will be required; do not answer unless these can be furnished; steady position; new equipment; all replies confidential. Box 607, AMERICAN MACHINIST.

OHIO

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Draftsmen familiar with detail crane design; state wages desired. The Toledo Massillon Bridge Co., Toledo, Ohio.

Wanted—Salesman to sell emery wheels in Ohio, Pennsylvania and New York; give age, experience, references and salary expected. Address "W. E. S." AMER. MACH.

Wanted—Five first-class diemakers; those used to blanking and forming; permanent employment and good pay. Address J. C. Lester, Supt., The Davis Sewing Machine Co., Dayton, Ohio.

Expert salesman wanted by the Defiance Machine Works, of Defiance, Ohio; must be thoroughly familiar with the general woodworking trade in the United States; one conversant with wheel and wagon manufacturing preferred; applicants should be under middle age and able to give first-class references; a good position for a high-class man. Box 571, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

Mechanical engineer with technical education, familiar with power plant, machinery and tools, transmission equipment, etc., for a large sheet-metal working plant in Middle West employing 1000 men; should have knowledge of tools and dies for blanking, forming and drawing sheet steel, brass and tinplate; force includes 60 diemakers, and equipment includes a large number of stamping and drawing presses, automatic screw machines, machine tools, electrical equipment, etc. Address, stating fully qualifications, experience and salary expected. Box 567. AM. M.

PENNSYLVANIA

Wanted—Lathe, boring mill and floor hands; good wages, steady work. The Blaisdell Machinery Company, Bradford, Pa.

Wanted—Draftsman, experienced in automobile work; give age, nationality, experience and salary expected. Box 544, AM. MA.

Draftsman—Bright, ambitious young man, one capable of doing detail work on motors, transmissions, axles, and other automobile work; one accustomed to detailing and making finished shop drawings required; bright future. Please communicate by letter or call in person. Mack Bros. Motor Car Company, Allentown, Pa.

We are increasing our force and invite applications from machine hands of all kinds, including men who can turn multiple throw cranks, bench hands, erectors, metal polishers, and Jones & Lamson turret lathe hands; shop located near Philadelphia and building marine gas engines; no labor troubles; give experience in detail. Box 591, AM. MACH.

Wanted—We have positions to offer from time to time for the following lists of first-class mechanics: Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—A superintendent; must be experienced in the manufacture of small motors, generators and controlling apparatus; this is an opportunity for the right man; the concern requiring the services of a superintendent is the largest in its line and the position offers exceptional opportunities for an energetic and capable man. Address stating age, experience and salary expected, Box 596, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A few agencies for Canada or the Province of Quebec by a salesman, fifteen years' experience in pumps, boilers, engines and machinery; would confine himself to one line. Box 346, AMERICAN MACHINIST.

ILLINOIS

First class mechanical engineer (28), experienced as mechanical draftsman and assistant master mechanic, desires change; references. Box 599, AMERICAN MACHINIST.

Designer with 8 years' experience in rolling mill, conveyer and transmission machinery, power plants, automatic and special machines; shop practice; technical education; interview if near Chicago. Box 600, AM. MA.

Superintendent; an energetic American, age 40, with an exceptional long and varied experience in the manufacture of duplicate machine parts; light and heavy; intricate metal stampings and various specialties; capable of analyzing methods and reducing costs in a practical way; references A-1. Box 595, AMERICAN MACHINIST.

MASSACHUSETTS

Foreman wishes position with reliable firm, first-class, all-around machinist, thoroughly familiar with modern shop practice and piecework system; 22 years' experience, 17 years as foreman, 18 years with same firm; location immaterial. Box 610, AMER. MACHINIST.

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 608, AMER. MACH.

MICHIGAN

Designer, experienced on jigs, fixtures and special machines; capable of taking charge. Box 609, AMERICAN MACHINIST.

MINNESOTA

Chief draftsman, experienced, seeks position. Address Box 558, AMER. MACHINIST.

NEW YORK

Foreman (35); tool and die work; executive, reliable, original, designer; Greater New York. Box 614, AMERICAN MACHINIST.

Mechanical engineer desires position as designer and chief draftsman for general contracting concern. Box 593, AMER. MACH.

Technical man with six years' experience as draftsman and designer, also two years teaching machine design, desires position. Box 605, AMERICAN MACHINIST.

Mechanical engineer, wide general experience, marine engines, valves, steam turbines and mill work, shop and drawing office, technical graduate, desires charge. Box 611, AMERICAN MACHINIST.

Superintendent or foreman, age 42, first-class mechanic, up to date in modern shop methods, wishes position, manufacturing high grade machinery or automobiles. Box 613, AMERICAN MACHINIST.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 578, AMERICAN MACHINIST.

Designer and engineer of proven inventive ability, graduate, 12 years' experience, fine and automatic machinery, adding machines, etc., open for engagement; any location. Address Box 604, AMERICAN MACHINIST.

Position wanted as sales manager of machinery house or as special representative of manufacturer; 17 years' selling experience; competent to handle everything connected with engineering sales work. Box 597, AM. M.

By mechanical engineer and draftsman with 7 years' experience in machine design, light automatic machinery, special machine tools, as well as rolling mills, hoisting, conveying and elevating, pumping machinery, power plants; two years assistant master mechanic; technical education; location immaterial; interview possible if in or near New York. Box 601, AMERICAN MACHINIST.

OHIO

Experienced superintendent, now employed, is open for change; expert on light and medium machinery, automobile work and sheet metal stamping; drafting room experience, and all-around factory man; American, strictly sober, honest and industrious; location, northern Ohio. Box 568, AM. MACH.

PENNSYLVANIA

Mechanical draftsman desires a change; 8 years' experience on automatic machinery and tools for interchangeable parts. Box 603, AMERICAN MACHINIST.

RHODE ISLAND

Advertiser, technically trained, experienced executive and salesman, with office and selling assistants, desires additional high grade line for New England. Box 602, AM. MACH.

FOR SALE

For Sale—Screw manufacturing business; excellent opportunity and profits; reasonable price; first-class machinery. Box 612, AM. M.

For Sale—Two Gridley single spindle automatics; one Woods No. 188 automatic cutting off saw. Sullivan Machinery Company, Claremont, N. H.

For Sale—42″ Bullard boring mill in good condition, having been in service only three years; send us your bill for the above. Detroit Stoker Company, Detroit, Mich.

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; good opening for manufacturing business. Geo. H. Church, Bergen, N. Y.

Machinery for Sale—20 h.p. Wagner electric motor, a.c., 220 single phase, 60 cycles, almost new, with starting panel and switch, for sale; cash bargain, $325. Imperial Machine Co., 261 Elm St., Newark, N. J.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.

Revolver and Rifle Barrel Work

By Frank A. Stanley

Fire arms manufacture requires an extensive equipment of machinery and tools, and much of the apparatus used is peculiar to this line of work.

The Hopkins & Allen revolver parts are produced in a series of operations performed on milling machines, shapers, profilers, turret machinery, etc. The rifle barrels are machined with equally important tools.

Some of the machines, attachments, special devices and methods for accomplishing accurate and satisfactory results.

The engravings in this article, which is the third in the series on the Hopkins & Allen Arms Company's methods, are with few exceptions views in departments where revolvers of various kinds are manufactured.

The illustration in Fig. 1 is a general view showing a group of milling machines in operation on the Hopkins & Allen safety police revolvers. Each machine here is equipped with suitable holding fixtures and cutters for turning out parts rapidly and accurately. A profiling operation is illustrated in Fig. 2, the work (a revolver receiver) the holding fixture, the former plate, cutter, etc., all being clearly seen in the engraving.

A Special Milling Fixture

An interesting profiling operation performed on a miller is shown clearly in Fig. 3. The fixture is designed for beveling a circular joint *A* on the revolver frame and the work is rotated to feed the circular edge around against the cutter. The fixture is constructed to handle right- and left-hand parts, the locating slots, pins and stops being duplicated at opposite sides of the faceplate upon which the work is mounted. The hardened stops on the periphery of the plate determine the angle through which the plate and work must be rotated, and after the preliminary adjustments are made the pieces are handled quickly. The work is located on the central pin hole and is secured quickly by one clamp as represented.

Using the Shaper

Another interesting operation is accomplished through the medium of the fixture mounted on the shaper, shown in Fig. 4. The tool *B* in this fixture cuts out a circular seat in the barrel extension, Fig. 5, forming part of the circular joint on the safety police pistol, this seat being engaged by the curved locking surface projecting above the receiver or frame, so that as the pistol is closed, the two main parts are drawn snugly together.

The shaper fixture which cuts this concave seat consists of a base attached to the shaper knee to which is pivoted a rocker *C*, carrying the cutting tool *B*, which is itself in the form of a movable slide with the tool forged at one end, while at the other it is adapted to be fed to the work by an adjusting screw *D*. The work is held as indicated in the base, and the upper part of the fixture is connected with a slotted bar *E* in the tool post of the shaper which slips over a pin at the side of the rocker. As the shaper ram travels to and fro, the rocking head *C* is oscillated, swinging the cutting tool down through the slot in the barrel lug of the revolver, thus producing the curved seat required.

It should be noted that the work is located in the fixture by a plug *F*, pushed through the pivotal hole of the barrel, which is, of course, the center from which the radius of the curved seat is struck. The bushings through which the locating plug is pushed, are extended inwardly a sufficient distance to form the bearings about which the upper or rocking member of the fixture is supported. This location of the pivot assures an arc of correct radius being cut in the work.

A Five-spindle Turret Lathe

The machine in Fig. 6 is equipped with a fixture which holds the revolver barrel while putting in the pin hole. The turret carrying the different tool spindles is indexed around and each spindle as it comes into the uppermost or working position, is thrown into action by shifting the belt from the loose pulley at the side, onto the spindle pulley. After the tool is withdrawn, the belt shifts again to the loose pulley and the turret is then indexed to the next position. With this arrangement the spindles remain idle until indexed to operative position.

Indexing Bench Millers

The machine in Fig. 7, which is one of several tools used on light work, cuts the ratchet teeth in the hub at the ends of the revolver cylinder. The work slide of the machine is operated by hand and the indexing and milling operations are accomplished with great rapidity. A number of finished cylinders will be noticed in the pan in which the machine is mounted.

Screw Broaching Machine

An interesting machine is illustrated in Fig. 8. This is a power-driven screw broaching press, which at present is utilized for forming the mortise for the cyl-

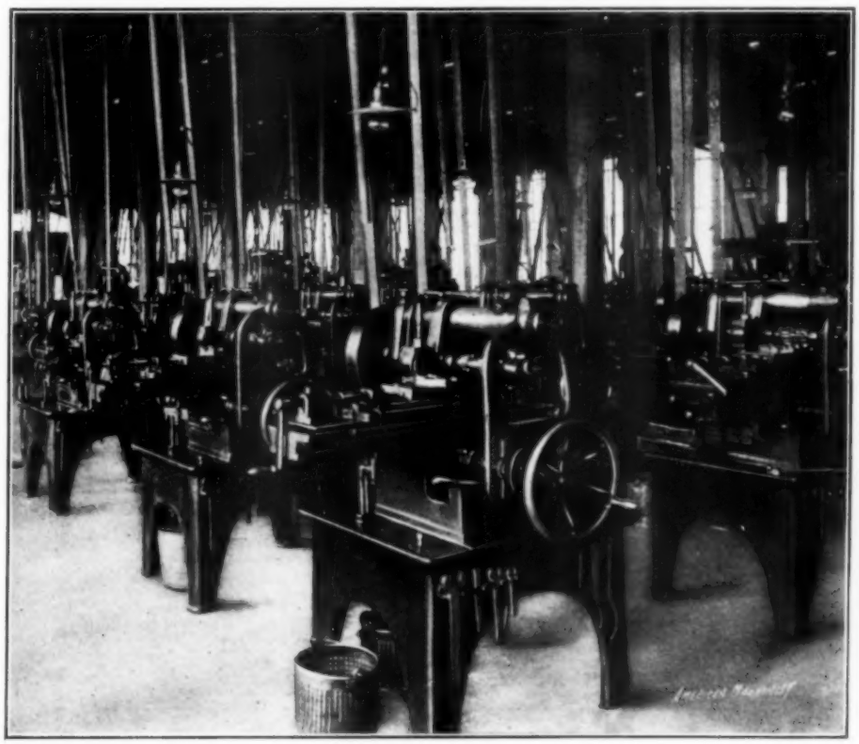


Fig. 1. Revolver Milling Department, Hopkins & Allen Arms Company

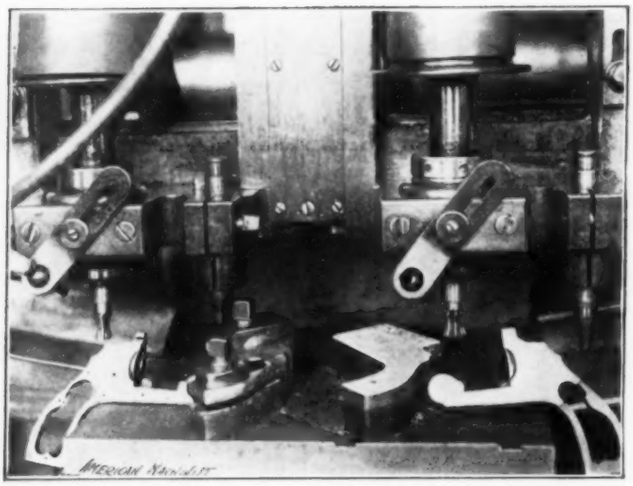


FIG. 2. PROFILING REVOLVER RECEIVER

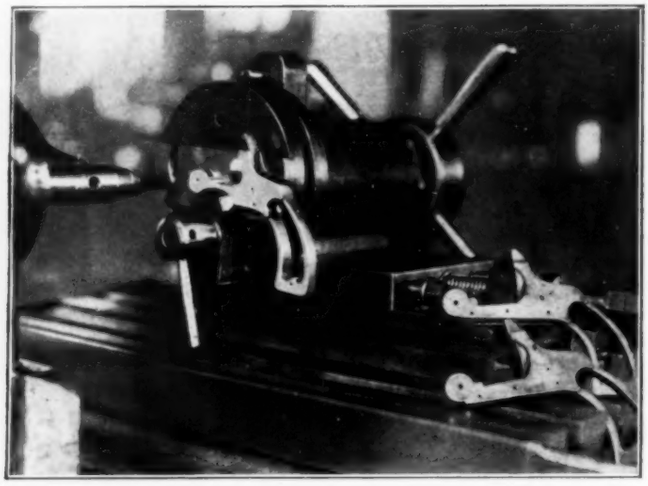


FIG. 3. BEVELING CIRCULAR JOINT

inder in solid revolver frames, as well as for broaching out various other square and irregular holes. The driving pulleys for this machine are provided with friction clutches, which are automatically controlled by the ram of the press as it travels in its guide. That is, when the ram on the down stroke strikes the stop, the forward driving friction is thrown out and the reversing pulley engaged to return the ram to its uppermost position, where, upon arrival, it throws out the reversing friction and remains stationary until the foot lever is again depressed to start the cycle of operations for the next piece of work.

ROTARY MILLING

Fig. 9 represents a Brown & Sharpe vertical-spindle milling machine with a rotary table arranged for milling the spherical surface *G*, known as the recoil plate. The revolver frame or receiver is located centrally on the fixture at the middle of the table and when adjusted properly to the special formed cutter it is an easy matter to rotate the table and form the recoil plate to the correct radius. The fixture takes care of that portion of the recoil plate projecting at both right and left sides of the receiver without readjustment of the work table.

REVOLVER FRAME JIG

The jig in Fig. 10 holds the receiver while forming the holes for barrel and cylinder pin. The turret drill is fitted with drills, reamers, taps, counterbore and facing tools, and the jig not only guides the drills, but when opened allows the facing tool to reach the upper end of the work which is exposed by the swinging back of the jig top.

AN OLD PROFILER

The machine represented in Fig. 11 is a profiler built by Wood & Light, presumably about forty years ago, possibly longer, and yet it is stated that the cutter spindle of this machine has not been replaced in all these years and it is still doing highly satisfactory work. A sketch of the spindle is given in Fig. 12 and as will be noticed, the lower bearing has an included taper of 25 degrees, measures about one inch at the bottom or small end, and approximately 2¼ inches at the larger end. This taper bottom bearing runs in a hardened-steel box; the upper end of the spindle is very slightly tapered and runs in another hardened box. The machine is in constant use and apparently will last for another generation.

The machine is illustrated as set up for profiling the outside and inside of the guards, and the method of holding the guard and guiding the cutter is clearly represented as is also the appearance of the work before and after profiling.

FITTING AND BLUING DEPARTMENTS

Two views in the revolver-fitting room are reproduced in Figs. 13 and 14. This department is clean, well lighted and fully equipped with benches and such tools as are required in assembling the work. As all of the constituent parts of the revolver are held closely to size in the manufacturing departments, there is little actual fitting to be done here aside from touching up joints, removing burs, fitting pins, etc.

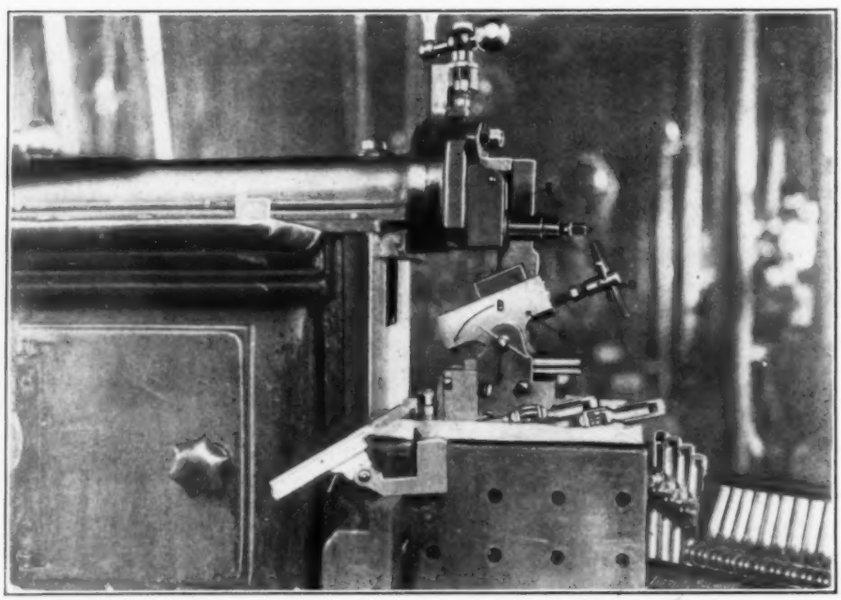


FIG. 4. CUTTING A CURVED SLOT IN THE SHAPER

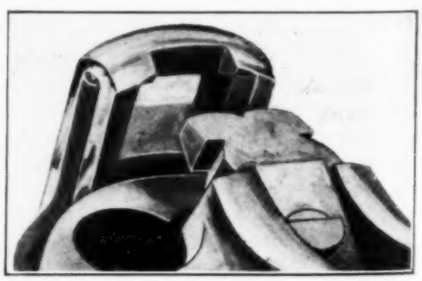


FIG. 5. THE JOINT ON THE HOPKINS & ALLEN SAFETY POLICE REVOLVER

Bluing Apparatus

The bluing of a large number of metal parts entering into gun and pistol construction is carried on in the department illustrated in Fig. 15. This shows a pair of charcoal pots of rectangular form, in which powdered charcoal as fine as flour,

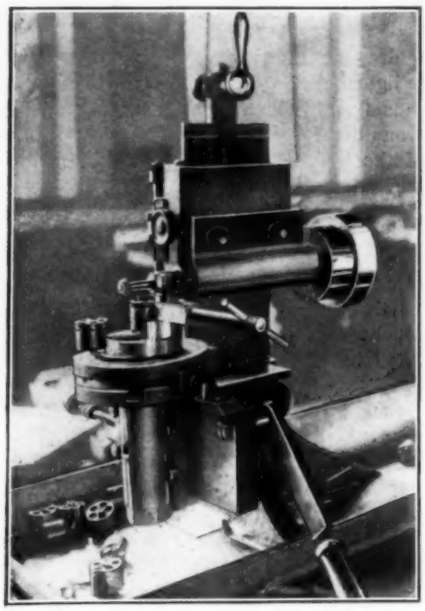


Fig. 7. Bench Miller for Cutting Teeth in End of Revolver Cylinder

is heated over a coal furnace until it is almost in liquid condition. Into this charcoal powder the parts to be blued are placed either by holding them on wires or securing a number of them to a handy fixture by means of which they may be readily immersed and withdrawn from

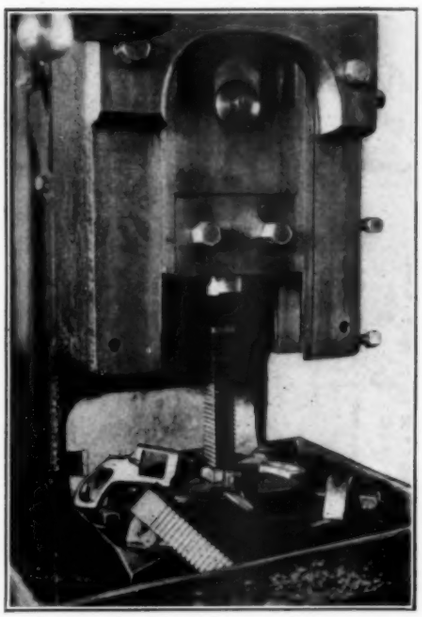


Fig. 8. Broaching Cylinder Opening in Solid Frame Revolver

the charcoal. Long practice is, of course, necessary in order to attain proficiency in the art of doing this work. After the piece has been heated a few moments, it is withdrawn, the surface brushed with a rag to permit inspection and the piece then put back; this process being repeated several times during which the surface of the work takes on various hues, until finally it assumes the blue-black appearance which indicates that it is finished.

Operations on Rifle Barrels

Figs. 16 and 17 illustrate some important operations in connection with the making of Hopkins & Allen rifle barrels. The first of these shows how the surfaces of five octagonal barrels are milled simultaneously. The fixture carrying the barrels to be milled has an indexing plate and crank handle and the five holding chucks are geared together so that when

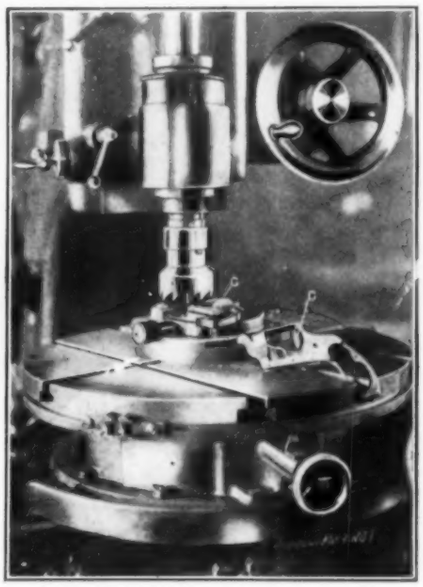


Fig. 9. A Circular Milling Operation

the index crank is turned for the milling of each of the eight flat faces on the barrel, the five barrels are indexed in unison.

The barrels being tapered, it is obvious that as flat after flat is milled and the work is indexed around, in forming the octagon, the supporting shoes under the work must be readjusted in order to contact with the bottom surface. This is

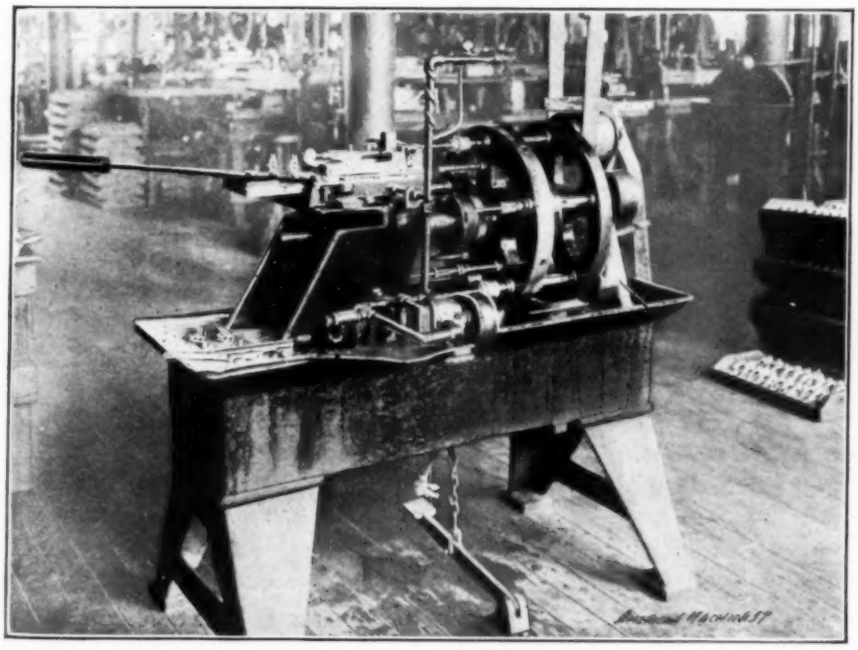


Fig. 6. Five-spindle Machine Drilling Pin Hole in Revolver Barrels

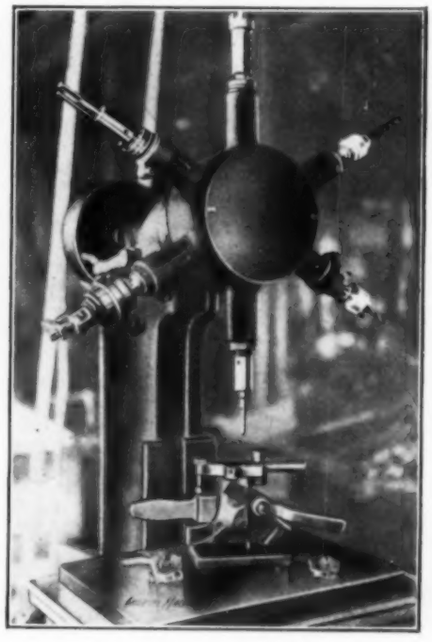


Fig. 10. A Revolver Frame Jig

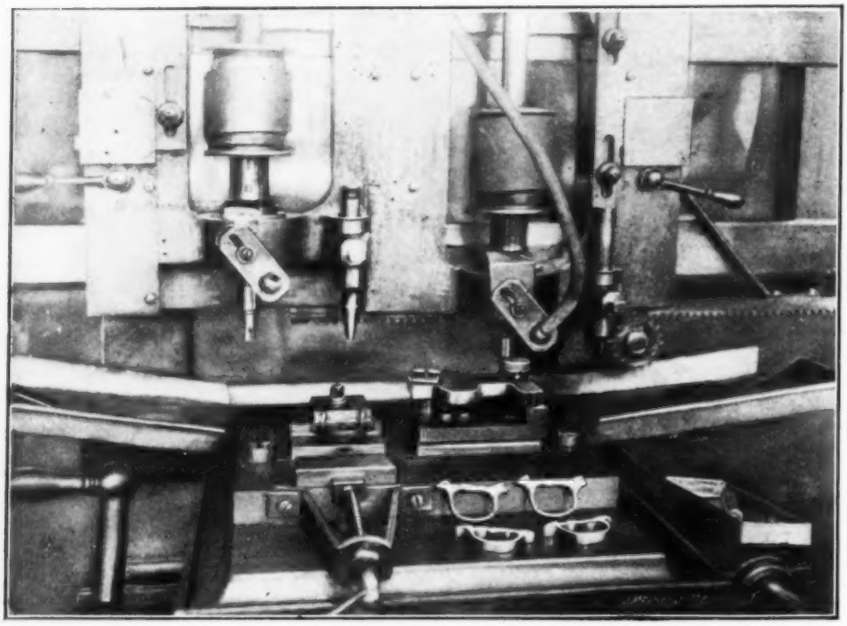


FIG. 11. PROFILING REVOLVER GUARDS

accomplished by having these supports in the form of wedges, fitting in guide blocks with similarly tapered surfaces so that the wedges may simply be slid forward, up the incline upon which they rest, until they are brought into proper contact with the work.

DRILLING AND RIFLING BARRELS

In drilling 22-caliber rifle barrels, a speed of 3000 revolutions per minute is maintained for the work while the drill, which is advanced without rotating, is fed about 0.0004 inch per revolution. The size of the drill is 0.214 inch, the bore being reamed 0.218 inch in three successive operations where four barrels are held at the same time on the machine and as many reamers drawn through simultaneously. Naturally, all the barrel-drilling operations are carried on under a flow of lubricant supplied to the work and the point of the drill under pressure.

The hand rifling machines in Fig. 17 are among the most important of the various tools designed by Superintendent Wright. The hand-operated carriage *A* by means of which the rifling cutter

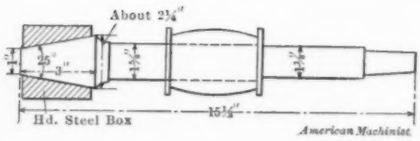


FIG. 12. OLD WOOD AND LIGHT PROFILER SPINDLE

is drawn through the bore of the work, is light and very easy in its action, as it runs upon four grooved wheels of generous dimensions guided by ways on top of the bed. The rifle barrel is held in the indexing spindle *B*.

RIFLING MACHINE DETAILS

These machines are constructed to rifle either constant or increased twist. At the back of the machine and below the bed will be noticed a long, straight bar *C*, the position of which determines the increase given the twist of the rifling, and which when set horizontally produces a helix of constant pitch. This bar, when set obliquely, operates a sliding rack under the carriage which acts upon the mechanism that rotates the rifling bar, the angular movement of the controlling bar increasing as the carriage moves toward the end of the bed and approaches the center from which the bar is pivoted, and this increase in angular motion produces a corresponding increase in the rate of movement of the rack through the medium of which the rifle bar is rotated.

If it is desired to cut a groove increasing from, say, one turn in 18 inches at the breech to one turn in 14 inches at the muzzle, the guide bar *C* can be set

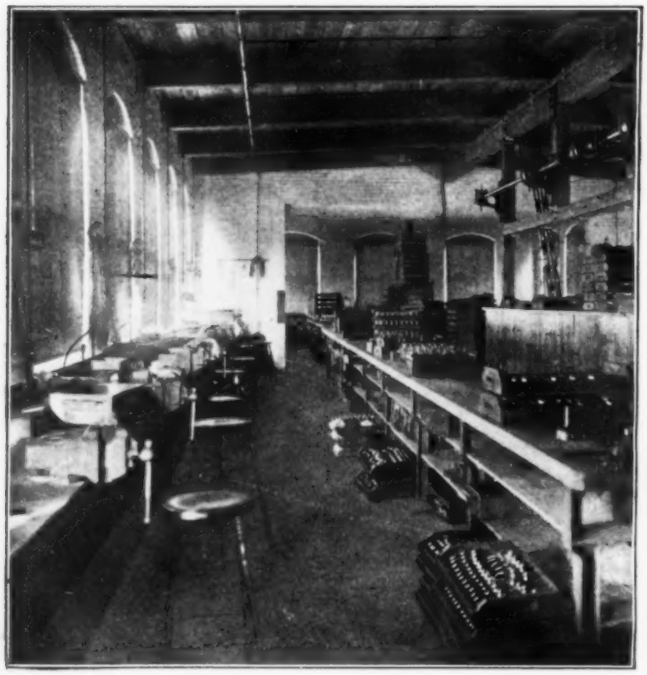


FIG. 13

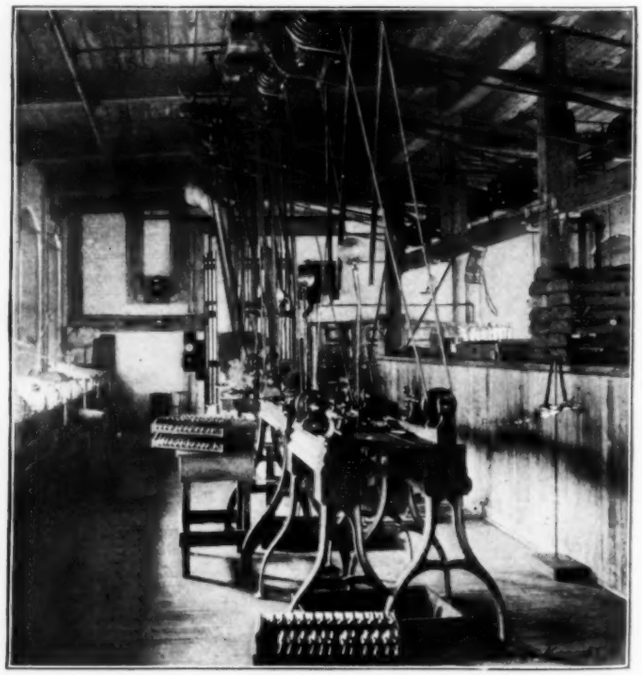


FIG. 14

REVOLVER FITTING DEPARTMENT

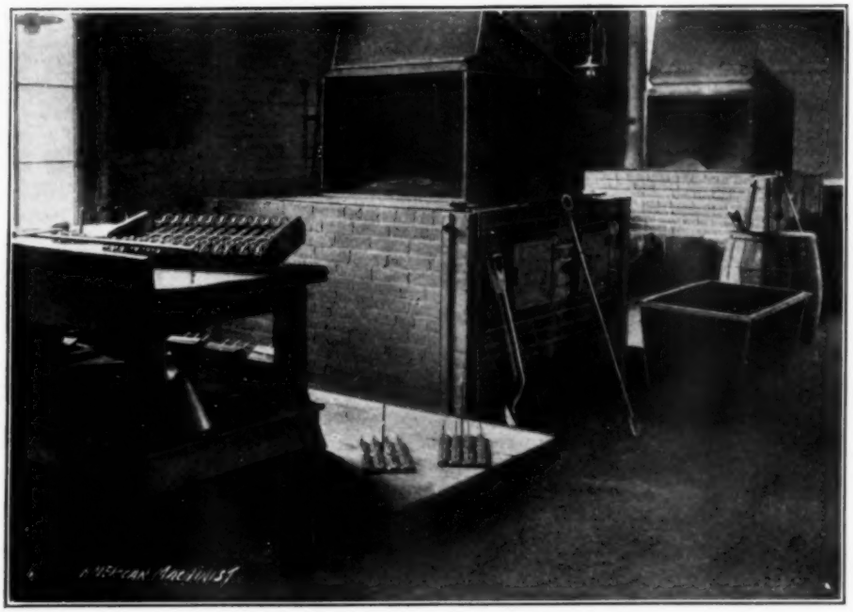


FIG. 15. CHARCOAL BLUING-FURNACES

so that the rifling-bar carriage *A* in traveling the length of the barrel will produce a longitudinal movement of the rack equal to 4 inches, this movement of the rack being against the travel of the carriage and, therefore, increasing by just its own rate of movement, the speed of rotation of the rifling bar above its velocity when starting in at the breech. No matter how slow or how quick a normal twist may be desired, if it is required to increase this twist it is readily accomplished by adjusting the controlling bar *C*.

ACCURACY OF ADJUSTMENT

The accuracy of the adjustment is determined by measuring with a scale the exact longitudinal travel during the rifling cut. Similarly, the accuracy of the setting of the bar to its horizontal position, when a constant twist is desired, is tested by noting if the rack remains absolutely stationary during the travel of the carriage along the bed.

After the five cuts have been taken around the bore, the rifling cutter must be fed out from its bar slightly for the next series of cuts, and this is accomplished automatically by a threaded stop screw against which the cutter-adjusting wedge strikes at the end of its travel, the stop screw being advanced automatically through the medium of a cam and ratchet actuated prior to each feeding movement.

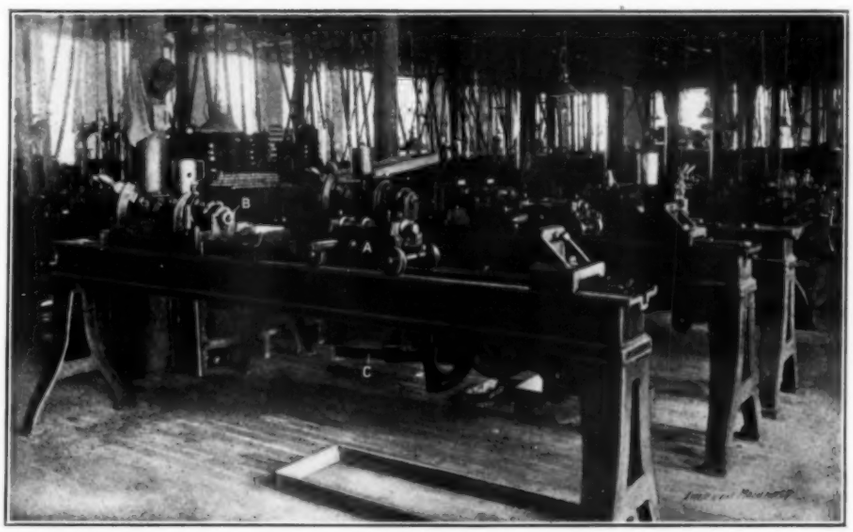


FIG. 17. RIFLING MACHINES

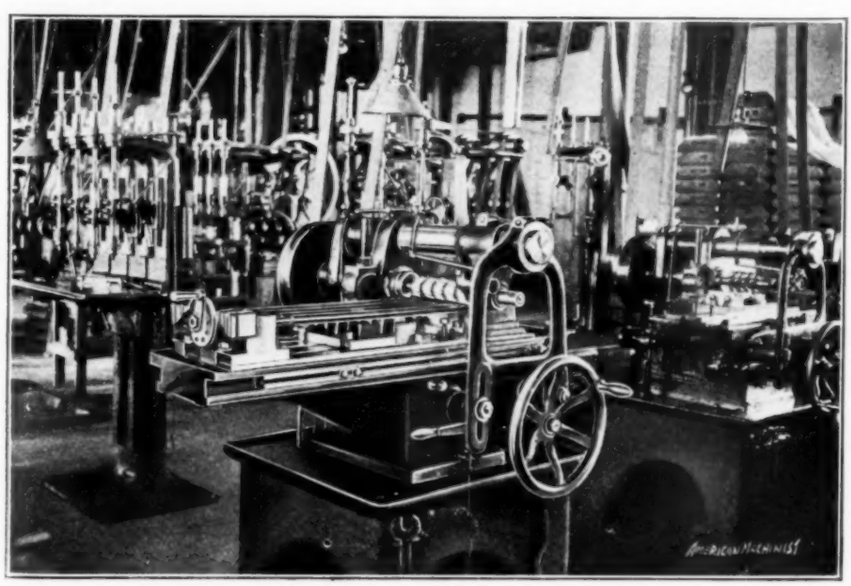


FIG. 16. MILLING OCTAGON RIFLE BARRELS

Efficient Automobile Bushings

In automobile construction there is a demand for a high-grade bearing bronze and it is cast principally in the form of bushings. They are usually small. The requirements of such bushings are severe, as oil may not be used as often as necessary on them and the pressure is considerable. Taking everything into consideration as good metal as possible should be used for them. According to the *Brass World* the following mixture has been found to give excellent satisfaction: Copper, 80 lb.; tin, 5 lb.; lead, 10 lb.; 5 per cent. phosphor-tin, 5 lb.

Use new metal only. Keep the mixture free from zinc as it will tend to make the lead sweat out. Cast at as low a heat as possible and good castings will be obtained. The molds, whenever possible, should be faced over with a good graphite blacking in order to prevent the sand from adhering. The castings will then be smooth. Green sand can be used for making the castings.

While the castings may seem soft in machining, the presence of lead will give the bearing a long life and freedom from heating and wear.

Designing Dies Economically

By Guido Sacerdote

How to design dies in order to obtain the least waste in spacing of blanks. Considerations very often overlooked in die design.

In the design of blanking dies, proper attention is not always paid to the considerable differences in the quantities of material required for a certain number of pieces, according to the different ways in which a blanking die can be laid out.

It has been my experience, that in many shops the planning of these and other dies is left entirely to the foreman of the tool room, or to the mechanic who must make the die; these men usually make the die in the way which most readily presents itself, that is, with the blank disposed crosswise to the strip, this being wide enough to suit the maximum dimension of the blank. Even when they should see some better way of locating the blank in the strip, the best way, or else the one which requires the less amount of material, can only be found at the drawing table, by laying out all the possible ways of cutting the blanks, and figuring the surface required in each case.

Of course, for small quantities the design of the die is immaterial, except in the case of costly materials; but with large quantities to produce, such as is usually the case with die work, the savings which can be effected by a proper design of the blanking dies quite repay the time spent by the designer.

Fig. 1 shows seven different ways of cutting a T-shaped piece, of which the dimensions are given; in all the drawings the blanks are disposed in the strip leaving 1/16 inch between each blank.

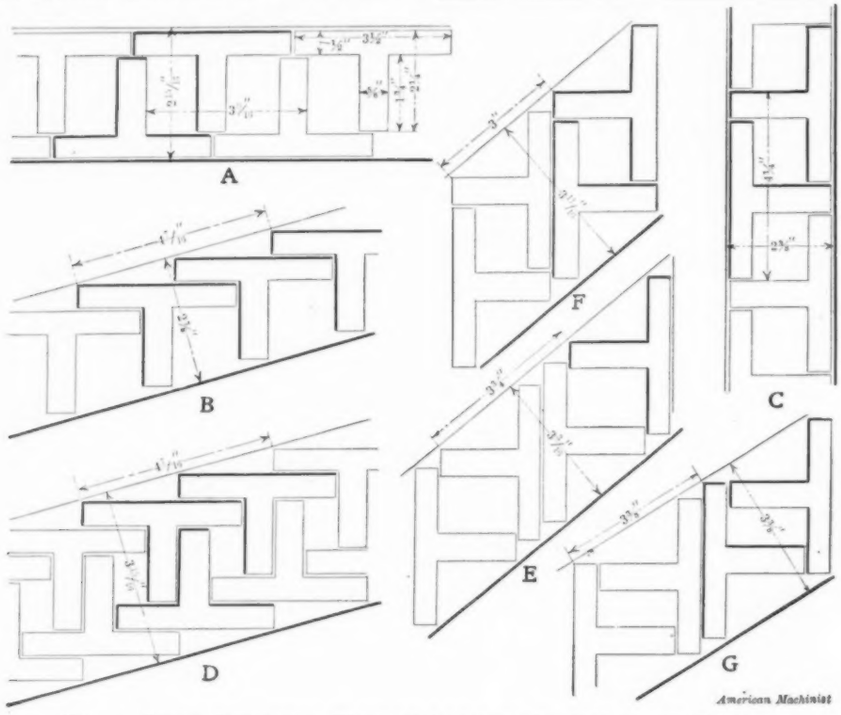


FIG. 1. SEVEN DIFFERENT WAYS OF LOCATING BLANKS IN THE STOCK

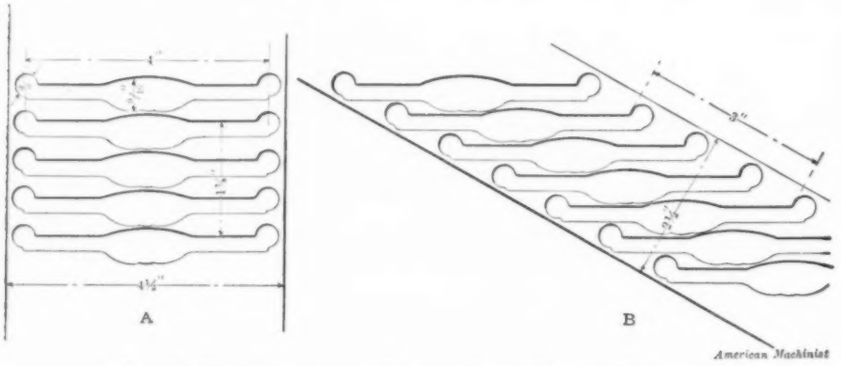


FIG. 2. TWO METHODS OF PLACING LONG NARROW BLANKS

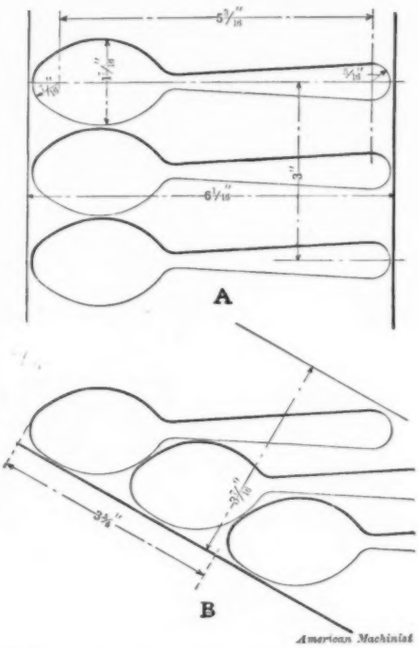


FIG. 3. LAYOUT FOR SPOON BLANKING DIES

The following table shows the difference in the amount of material required in each case.

In this case the disposition which gives the most saving in material is the one shown at *D*. It might be objected that this either requires two punches, punching two blanks at one time, or a reversing of the strip after the first set of blanks has been blanked out: but such is the case also with the methods shown in *A C E F G*, each requiring more material than the arrangement *D*. It may be further added, that the expense of mak-

Figure 1.	Dimensions, Inches.	Surface, Square Inches.	No. of Blanks.	Surface, P. Blank.	Difference Between Highest and Lowest.	Percentage Saving.
A	2 1/16 x 3 5/16	10.465	2	5.232	.....	
B	2 1/8 x 4 7/16	12.758	2	6.379		
C	2 1/8 x 4 1/4	10.094	2	5.047		
D	3 1/16 x 4 7/16	17.472	4	4.368	2.011	31½
E	3 5/16 x 3 1/4	11.953	2	5.976		
F	3 1/16 x 3	11.062	2	5.031		
G	3 1/8 x 3 1/4	11.391	2	5.695		

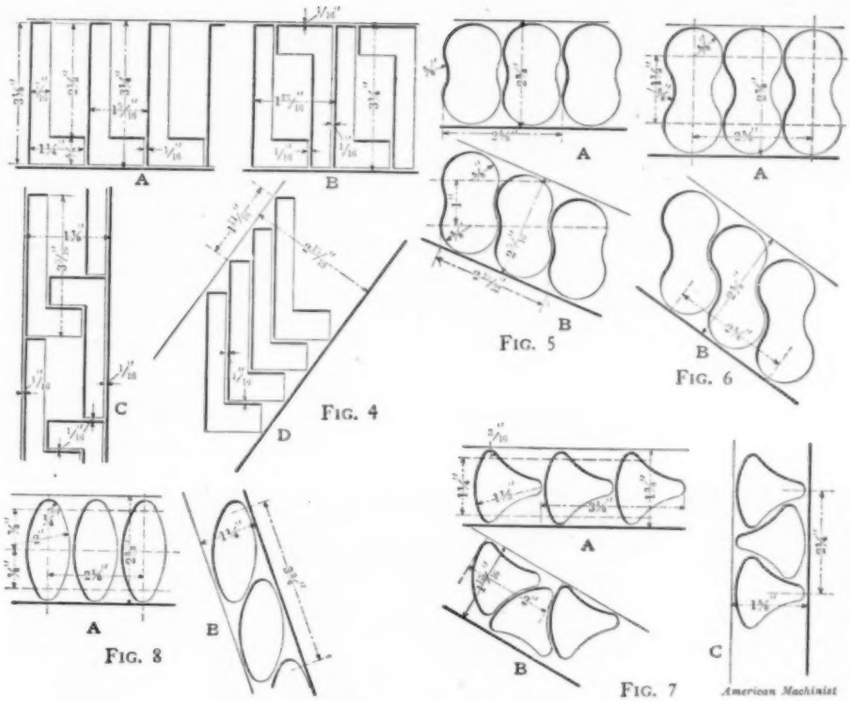


FIG. 4 FIG. 5 FIG. 6 FIG. 8 FIG. 7

OTHER METHODS OF SPACING BLANKS

	Dimensions, Inches.	Surface, Square Inches.	No. of Blanks.	Surface, P. Blank.	Difference Between Highest and Lowest.	Percentage Saving.
Figure 2						
A	$1\frac{7}{8}$x$4\frac{1}{2}$	8.437	3	2.812		
B	3x$2\frac{1}{2}$	7.500	3	2.500	0.312	11
Figure 3						
A	$6\frac{1}{4}$x3	18.187	2	9.093		
B	$3\frac{7}{16}$x$3\frac{3}{4}$	12.891	2	6.445	2.648	29
Figure 4						
A	$1\frac{5}{8}$x$3\frac{1}{2}$	4.266	1	4.266		
B	$1\frac{7}{8}$x$3\frac{1}{4}$	5.891	2	2.945		
C	$1\frac{1}{8}$x$3\frac{7}{16}$	5.976	2	2.988		
D	$1\frac{1}{4}$x$2\frac{1}{8}$	4.957	2	2.478	1.788	42
Figure 5						
A	$2\frac{1}{8}$x$2\frac{3}{4}$	6.234	2	3.117		
B	$2\frac{1}{16}$x$2\frac{13}{16}$	6.00	2	3.00	0.117	$3\frac{3}{4}$
Figure 6						
A	$2\frac{1}{2}$x$2\frac{7}{8}$	7.547	2	3.773		
B	$2\frac{3}{8}$x$2\frac{3}{8}$	6.890	2	3.445	0.328	$8\frac{1}{4}$
Figure 7						
A	$1\frac{3}{4}$x$3\frac{1}{4}$	5.469	2	2.734		
B	$1\frac{7}{8}$x2	3.625	2	1.812	0.922	$33\frac{1}{3}$
C	$2\frac{1}{4}$x$1\frac{3}{4}$	3.656	2	1.828		
Figure 8						
A	$2\frac{1}{4}$x$2\frac{3}{8}$	5.047	2	2.523		
B	$1\frac{1}{4}$x$3\frac{3}{4}$	4.687	2	2.343	0.180	7

ing a double punch will be partially or totally balanced by the saving in labor, two blanks at a time being cut, according to the quantity of pieces to be made.

If, however, it should be necessary or convenient to have one punch only, the method commonly used of cutting the blank crosswise to the strip, not shown in the sketches, would call for a surface per blank of 3⅝ (width of strip) x 2 5/16, or 8.383 square inches. The disposition *B* shown, also calling for one punch only, requires 6.379 square inches for each blank, realizing a saving in material over the former scheme of about 24 per cent.

Again, the saving between the highest, 8.383, and the lowest 4.368, amounts to the conspicuous figure of 48 per cent.

The other illustrations show different ways of cutting blanks of different shapes, and the results are given in the following table:

Now, taking for instance the spoon shown in Fig. 3, to be cut out of brass weighing about two pounds to the square foot; in one million pieces the difference in the quantity of material required in the two arrangements shown amounts to 18,390 square feet, or 36,780 lb. of brass; yet, a die, cutting blanks as shown in disposition *A* has actually been seen by me. Is this matter not worth some consideration?

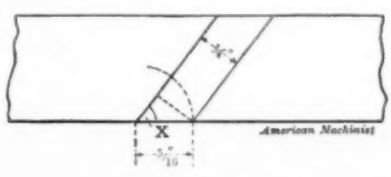
According to the *Mechanical World* a cement which is effective for cementing rubber to iron, and which is specially valuable for fastening rubber bands to bandsaw wheels, is made as follows: Powdered shellac, one part; strong water of ammonia, ten parts. Put the shellac in the ammonia-water and set it away in a tightly closed jar for three or four weeks. In that time the mixture will become a perfectly liquid transparent mass, and is then ready for use. When applied it forms a firm bond.

Slotting Piston Rings

By James F. Hobart

When slotting piston or steam packing rings with a straight diagonal cut, the problem frequently arises of determining the angle at which the slot shall be made, with a given width of cutter, in order to diminish the diameter of the ring a certain amount. In the instance represented by Fig. 1, it was necessary to reduce the diameter of the ring about 0.099 inch. This calls for the removal of about 5/16 inch of circumference of the ring.

The problem is to determine the angle *X*, at which the cutter shall be set to remove 5/16 inch of the ring's circumference, the thickness of the cutter being ¼ inch. The solution of the problem may conveniently be effected by the use of a table of natural sines. In the figure, let the radius be made equal to the amount of material to be removed from the circumference of the ring, namely, 5/16 inch, or 0.3125 inch, and the thickness of the cutter, 0.25 inch, divided by 0.3125 will then be the sine of angle *X*. This is equivalent to 0.8.



SLOTTING PISTON RINGS

Upon looking up the angle corresponding to 0.8 in a table of natural sines, it is found to be nearly 53 degrees, 10 seconds, the sine of which: 0.8004.

This method may be used also to determine the width of cutter necessary to remove a stated arc of circumference when a given angle of cut is required to be used.

Although this may not seem necessary to the man who is doing the work, it is safe to say that somebody has figured this all out carefully before the work came into the shop.

Tools for Making Relay Frames

By W. F. Hoffman*

The manufacture of telephone relay frames requires accurate and fine-finished work and the methods used represent good punch and die practice.

*Superintendent American Automatic Telephone Company.

The accompanying halftones illustrate a set of tools for making telephone relay frames. The finished frame is shown at *A*, Fig. 1, and in the same group at *B*, *C*, *D* and *E*, the frame is shown in the preceding stages of manufacture. The pieces are made from ⅛-inch soft cold-rolled steel, and are punched from a strip wide enough for making two abreast, as shown at *F*, Fig. 1; by handling in this manner very little scrap material is left.

In Fig. 2 the blanking die is shown at *G* for producing the piece *B*, Fig. 1. The general construction of this die will be readily understood. The stripper *H* is fastened to the die by means of screws and is machined to take the strip to be punched. The trip finger or stop for the strip is also attached to the stripper. In this particular case the finger is bent, as will be noticed, to save steel in the die and stripper. A straight finger would have answered had there been sufficient space on the stripper for inserting it. It was necessary to have the space between the edge of the die and the stop so as to get in the ear of the blank when punching the second row out of the strip. This will be readily seen by referring to *F*, Fig. 1.

The die for the first forming operation, piece *C*, Fig. 1, is shown at *I*, Fig. 2. This is of the built up type, with a pad resting on a rubber buffer for steadying the pieces while forming, also for throwing them out after forming. The side and end pieces of the die are worked out to the shape of the blank, thereby forming an accurate gage for this operation.

In Fig. 3 the piercing die is shown at *J*, and the operation performed is seen at *D*, Fig. 1. The piece is located on the face of the die by means of four pins. A spring stripper is used on the piercing punches. This operation was deemed necessary on account of the closeness of the slots to the sharp bend as indicated at *D*, Fig. 1.

The last bending operation *E*, Fig. 1, is done in the die *K*, Fig. 3. This is a plain pad bender, with pins in the pad for properly locating the piece. The upper ends of the punch and punch-holder are cut away to allow space for the portion *X*, of piece *E*, Fig. 1, to enter, also for sliding the piece off of the punch after forming.

In Fig. 3 is also shown at *L* the drill jig in the closed or locked position ready for drilling the pieces. The same jig will be noticed partly opened, at *M*, Fig. 1, showing the piece in position inside of the jig. It will be noticed by referring to the halftones, that these tools are well finished, it being the custom at this plant to have the tools pleasing to the eye as well as accurate; it has also been found that the persons using the tools take pains to handle them carefully and clean them when through with them.

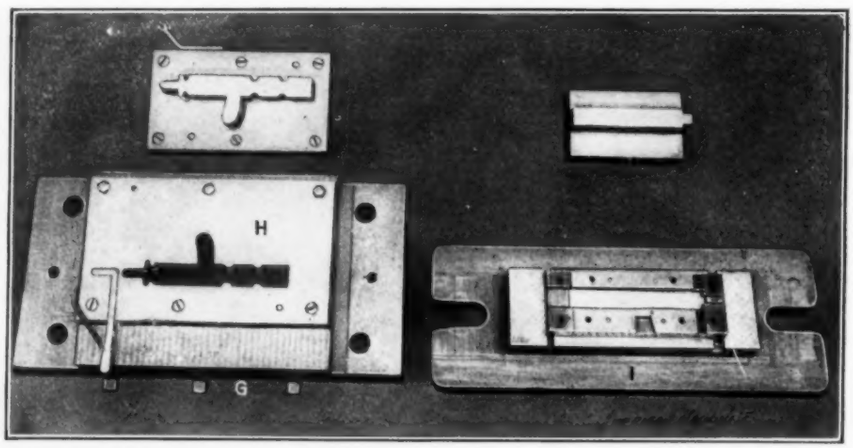


FIG. 2. BLANKING AND FORMING DIES

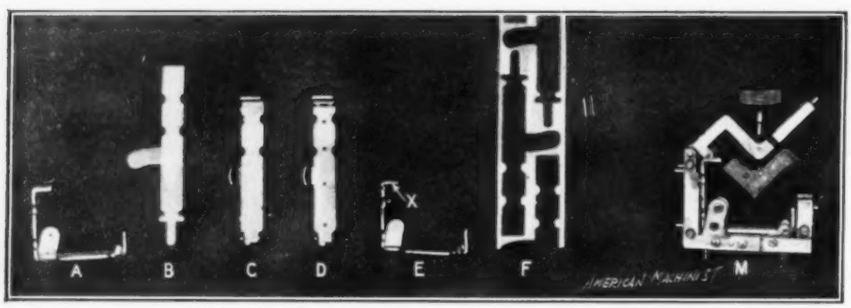


FIG. 1. THE RELAY FRAME IN VARIOUS STAGES AND A DRILL JIG

Speaking of machinery patents, a recent issue of the United States Patent Office *Gazette* lists 71 patents aggregating 1649 claims, all issued directly or by assignment to one man, and all on shoe making machinery. This is, without doubt, an unusual record.

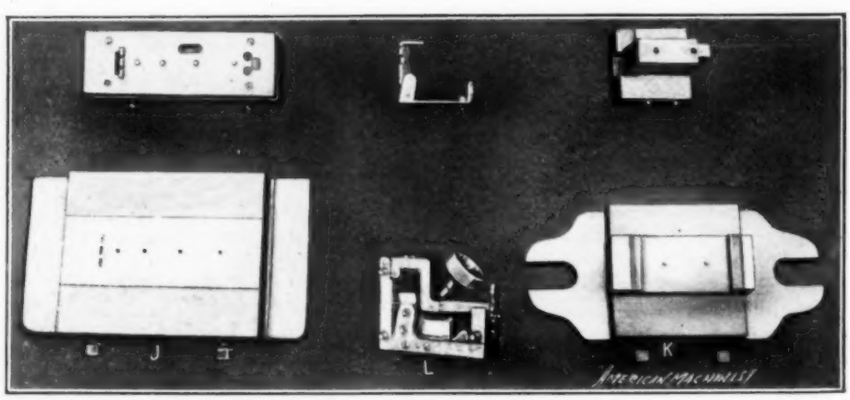


FIG. 3. PRESS TOOLS AND DRILL JIG

Model Foundry for Casting Iron—II

By E. F. Lake

A traveling sand mixer; core making methods that enable a small force to turn out a large quantity of cores; modern ways of cleaning and weighing castings used by the General Fire Extinguisher Company, of Providence, Rhode Island.

After dropping on the floor, most of the castings are broken from the gates and risers, but those that are not are broken off. The castings are then picked up with forks, and loaded in the buckets, so that none of the waste material will go into the cleaning room with the castings. These buckets are then suspended from the overhead track and sent into the cleaning room which is across an alley from the foundry building. The gates, sprues and waste materials are sent to the far end of the foundry building. From here the iron is sent to the charging floor and the waste material out the end door to the dump. Fig. 11 shows the men starting for the cleaning room with the casting.

Auto Sand Mixer

A larger view of the sand mixer is shown in Fig. 12. This is the Auto sand mixer that is made by a company of the same name in Piqua, Ohio. The knives shown at the rear of the machine occupy the same place as the brush on a street sweeper and revolve while the machine is moving ahead. This motion cuts the sand over better than it could be done by hand.

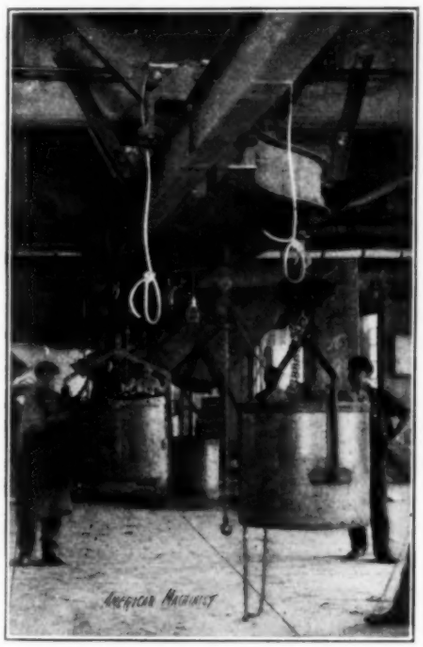


Fig. 11. Sending Castings to Cleaning Room

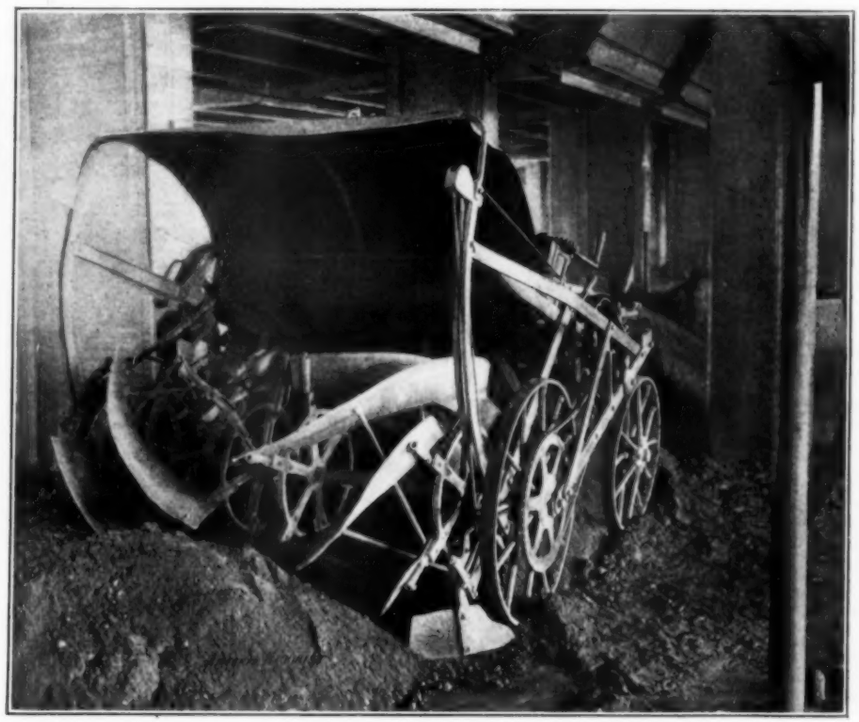


Fig. 12. Cutting the Sand with an Auto Sand Mixer

The machine is run by electricity from a cable and is governed by the levers shown in front. It travels through the pile of sand which is about 200 feet long and is then turned around and brought back. This double cutting puts the sand in good shape for the molders to use.

To the left of the rear of the machine is shown the pit into which the sand is shoveled after being cut, and above it the wooden box upon which it is conveyed.

When the sand on this side has been cut, the machine is taken to the opposite side of the shop and run through a similar pile of sand. It cuts over the sand in the entire shop in about an hour and to do this work by hand would require the services of quite a large gang of men working all day.

Dropping the Bottom

When the heat is over the bottom of the cupola is dropped onto irons and hauled out from under the cupola as shown in Fig. 13. It is then broken up and put into the tumbling barrel separator shown to the left of the picture. Here the iron is separated from the slag, sand etc., and is taken to the charging floor on the elevator to be remelted. Thus all the particles of iron are separated from the refuse and none of it is sent out into the dump to be wasted, as is the case in a great many foundries.

Core Sand Mixer

To the left of the view of the lower floor shown in Fig. 10, shown on page 1048, is located the core sand mixer and elevator shown in Fig. 14. Here the core sand is ground up to the proper fineness, all the stones, gravel, etc., screened out, and the proper materials mixed with it to make it ready for core making. It then goes into the chute underneath the machine and is picked up by the conveyers that convey it to the floor above, where the core room is located.

All of the dry-sand cores, with the exception of a few of the larger ones, are made by girls. The core room in which they work is shown in Fig. 15. This is one of the cleanest rooms of this kind which it has been my pleasure to be in, and the result is that the company is able to obtain a good class of help and keep it. These cores are all made on benches and placed on plates. When the plates are full they are placed on the racks to the left of the coremakers, and are taken from there to the core ovens shown back of the racks.

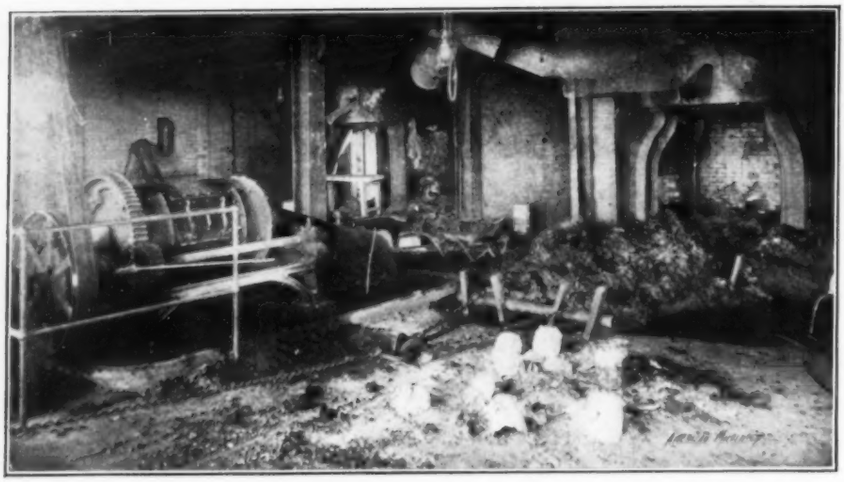


FIG. 13. DROPPING BOTTOM OF CUPOLA AND SEPARATING THE IRON

CORE OVENS

These core ovens are built in pairs, two half-round sections forming one oven. The front and back views are shown in Figs. 17 and 18; the back being next to the machine molders' floor. The heat comes from the floor below and is regulated by the valves shown at the back of the oven. The gases are taken off through the system of pipings shown above the ovens, and no foul gases get into the core room.

The core boxes are all made of iron and an idea of the different sizes and various styles of cores made can be obtained from a glance at the storage racks of core boxes shown in Fig. 16. It is the custom in this core room to give the girls the larger cores to make in the forenoon, and in the afternoon switch them over to the smaller cores, as in making these they are enabled to sit down.

CLEANING ROOM

As said before the castings are cleaned in a separate building, and this cleaning room contains some novel features. A general view of the room is shown in Fig. 19.

To the extreme right of the picture, back of the office, the castings are sorted and packed, as this end of the room is used for storing.

To the extreme left are shown the emery wheels where the fins, gates, etc., are ground off, and the finishing touches given the castings before sending them to the machine shop.

In the backgrounds are located six ordinary tumbling barrels and a special automatic tumbling barrel where the castings are cleaned when they first come from the foundry.

AUTOMATIC TUMBLER

A better view of the automatic tumbling barrels is shown in Fig. 20. The castings are brought from the foundry in buckets, rolling on the overhead track, shown in the upper right-hand corner of the picture, and are dumped on the floor at the charging end of the barrels. They are then shoveled into the end of the barrels by the workmen together with the necessary stars for cleaning them. As the barrel revolves the castings are tumbled and moved to the far end by a worm inside the barrel.

At the far end of the barrel they are constantly forced out as shown in Fig. 21, by the castings being fed up by the worm. Thus by keeping an operator shoveling

FIG. 15. MAKING SMALL DRY-SAND CORES

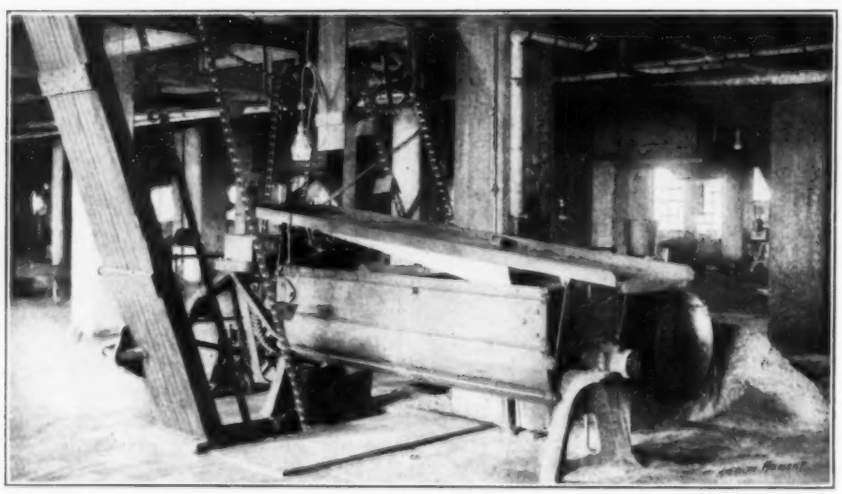


FIG. 14. MIXING AND ELEVATING THE CORE SAND

in the castings the barrel can be made to operate continuously.

At the center of the barrel is located a pipe through which an air suction carries away all of the dust that accumulates from the tumbling, so that when the castings leave the barrel there is no dirt but only the clean castings and iron scraps that were used in the tumbling. Here by picking them up with forks the scrap rattles through to the floor and the castings are placed in iron barrels and taken to the grinders.

WEIGHING FOR COUNT

After being ground, the castings, that are taken to the machine shop, are wheeled to the scales on special barrel trucks as shown in Fig. 22. Here the clerk places from 2 to 10 castings in a scoop, according to their size, and the

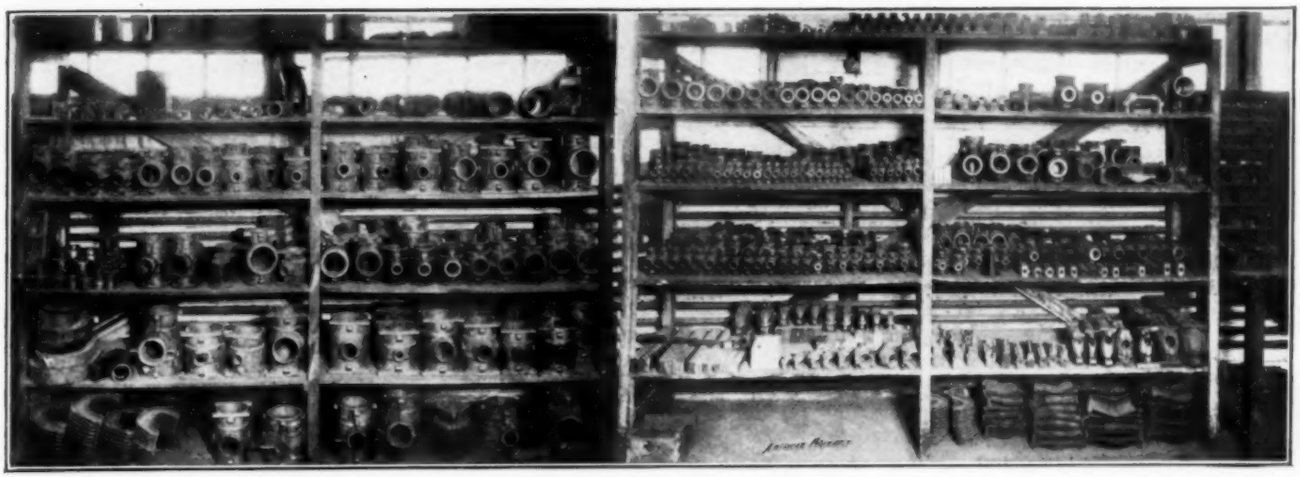


FIG. 16. RACKS FOR SMALLER CORE BOXES SHOWING STYLES AND SIZES OF BOXES USED

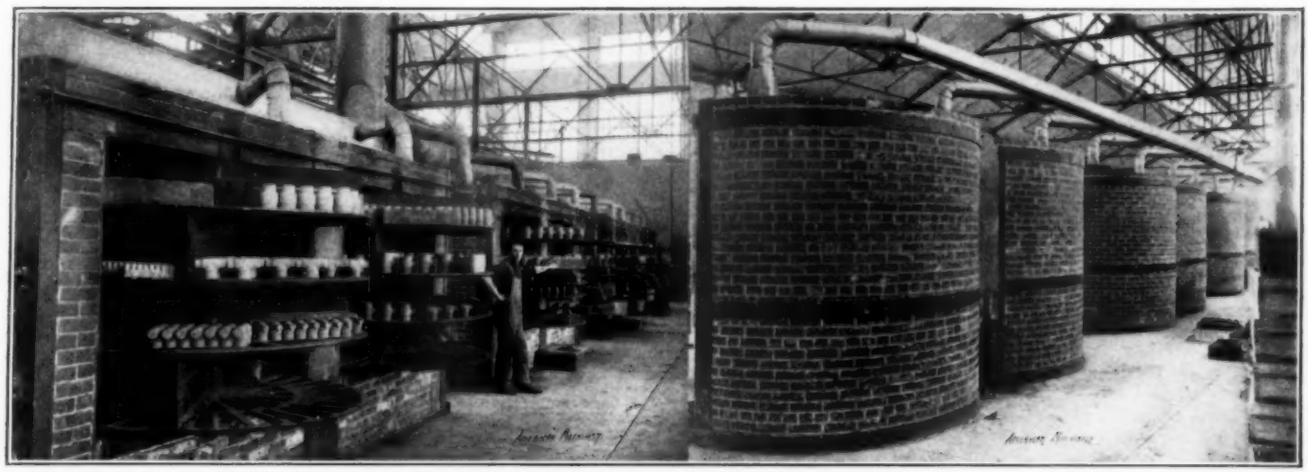


FIG. 17. FRONT OF CORE OVENS

FIG. 18. BACK OF CORE OVENS

FIG. 19. THE CASTING CLEANING ROOM

barrel of castings on the platform. The scales then automatically give him the count, or the number of castings that the barrel contains, after deducting the weight of the barrel.

Conclusions

While the tonnage in this foundry is not very large, owing to the small work, it will still compare favorably with many foundries that are casting big work on an equal amount of floor space. This method of taking the sand out of a chute as fast as it is being made into molds and pouring and shaking out the castings as fast as the molds are made, as well as sending the sand and hot castings to the floor below, makes it possible for a molder with a small floor space to turn out a large amount of work.

The molder's floor not being filled with large piles of sand for him to wade through or around, or a floor with a large area on which to stack up molds ready for the afternoon pouring, as is the case in the old style foundry, makes it possible for the molder to keep his floor so clean and do so little walking that he is enabled to get a maximum output by exerting a minimum amount of energy, as every move is made to count.

By having the overhead track on which to convey the ladles of molten metals to the molders' floors, makes it possible to use a small gangway and still not have the ladle men in each others' way while carrying the iron.

The apparatus used for cutting over and mixing the sand, as well as conveying the castings, while they are yet hot, to the cleaning room, and conveying the waste materials to the dump, are simple and inexpensive and yet they enable the work to be done with a minimum amount of labor.

The thought and ingenuity shown in the design of every detail of this foundry, the installation of its apparatus, and the systematic methods of operating it and moving the materials, would indicate that the days of the old superannuated foundry methods have passed. This is one of the best examples of the revolution that is taking place in this business. It also proves that the proper thought expended in handling the materials both before and after casting and in making good conditions under which the workers can perform their labor, most surely results in good for the owners by enabling the workers to produce more and better work, and thus decrease the cost of production and enhance the profits.

It may be argued by some that the class of product produced in this foundry makes the methods shown more easily adopted, and while this may in a measure be so, this plant, no doubt, contains several suggestions that can be applied in almost any line of foundry work.

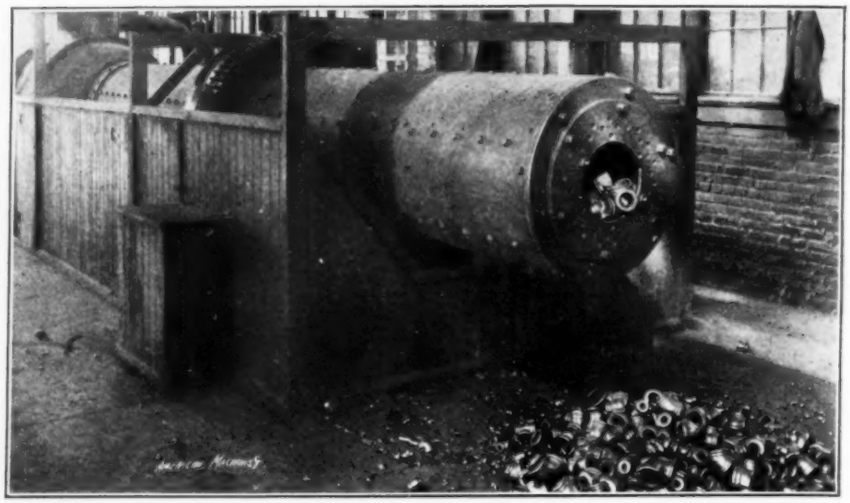


Fig. 21. Discharge End of Automatic Tumbling Barrel

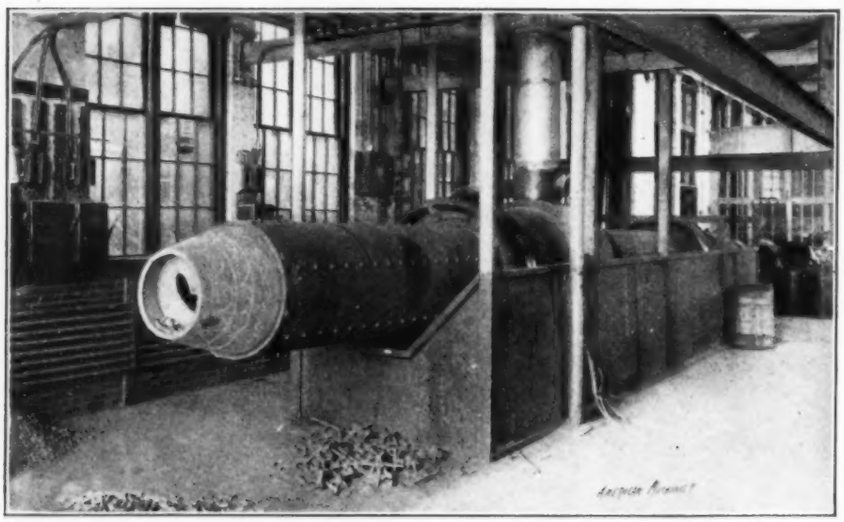


Fig. 20. Automatic Tumbling Barrel with Charging End in View

Fig. 22. Weighing the Castings to Get the Count

Energy of Compressed Air

By Snowden B. Redfield

An analysis of the power and heat transformation taking place in an air compressing cylinder, proving that all of the energy coming from the coal pile, to drive the compressor is transformed into heat which is usually lost in radiation and that it is the expansive force of the atmosphere which actually drives the pneumatic tool.

Up to the present time, for many classes of work, no other medium of power transmission has successfully taken the place of compressed air. Its ultimate economy in dollars and cents is well recognized, but there still are many phases of its nature not universally understood, which have led to the promotion of schemes for power development and transmission, with which, if the backers and those brought into the transaction were more conversant, they would have nothing to do, and so would be spared financial loss.

The most universal piece of practical knowledge on the subject of compressed air is the fact that it requires power to compress it, and that when once compressed, it has the capacity of doing work in various machines designed for that purpose. It is also known, though not so widely, that the transformation of power into compressed air, and from compressed air back to power again, involves considerable loss. Another well known fact is that air while being compressed becomes greatly heated, and that while expanding in the working machine it grows intensely cold, as is often evidenced by the freezing of exhaust ports of pneumatic machines, much to the discomfort and annoyance of the operators.

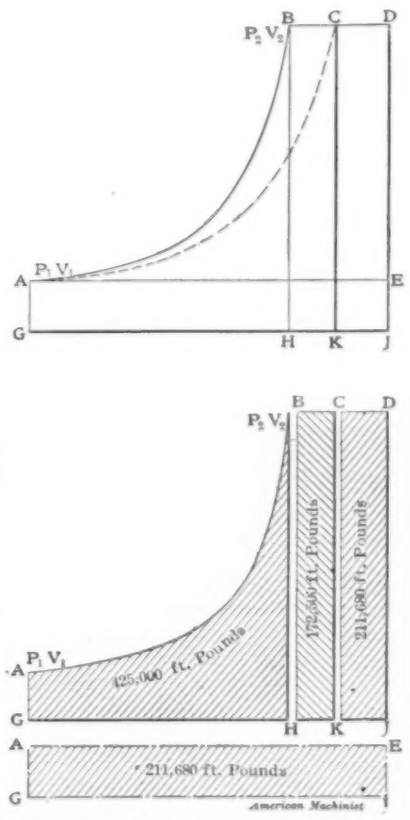
What is probably not often realized by the practical man is the fact that the greatest losses in power economy of compressed air are due directly to these evidences of heat and cold. However, what would probably prove the crowning surprise to this practical man would be the statement that, of all the energy in the coal burned to drive the compressor, not one foot-pound of this energy reaches his air-operated machine through the compressed air, but that what really drives this machine is the expansion of the atmosphere itself and that the energy required to expand this atmosphere comes from the heat in the atmosphere.

The truth of the matter is that all the work done upon the air in compressing it is transformed into heat, and this heat is usually entirely dissipated into the water jackets and intercooler of the compressor and after cooler if one is used, or in radiation from the pipe line, before reaching the driven machine. The compressed air reaching its destination at atmospheric temperature, no matter what its pressure, contains not one foot-pound more energy than it contained before compression.

These are very radical statements and those who are interested will insist upon convincing proof before accepting them as truths. The proof of these statements must necessarily involve theory and mathematics, but in order to overcome the well known popular aversion to formulas, the arithmetical results of each step will simply be stated.

Condition of the Problem

The diagrams shown will be recognized as an adiabatic single-stage indicator diagram of an air compressor, the lower one being separated into its component parts. The area $A\,B\,D\,E$ represents the net work done in the compressing cylinder. The line $A\,E$ represents the absolute pressure of the atmosphere or 14.7 pounds per square inch, and the line $B\,D$ represents the discharge pressure, which, to illustrate a practical case, is made 114.7 pounds per square inch absolute, or 100 pounds gage. To avoid decimals, the volume represented by the length $A\,E$ may be taken to represent a cylinder volume of 100 cubic feet, and it will be assumed that the piston makes one stroke per minute, thus compressing 100 cubic feet of free air from atmosphere to 100 pounds gage pressure in one minute.



Components of an Air-compressor Indicator Diagram

Work Done in Compressing the Air

The principles of thermodynamics, as illustrated by the familiar indicator diagram, teach us that the work done in compressing a gas from one pressure and volume to another, by any law that may be represented by a line, as for instance the adiabatic curve $A\,B$, is equal to the entire area under that line, down to the absolute zero line, this area, of course, being figured to the proper scale.

Bearing this in mind, we have that in moving the piston to compress the air in the cylinder under consideration, from pressure and volume $P_1\,V_1$ to pressure and volume $P_2\,V_2$, the work done on the air by the piston is represented by the entire area under the curve $A\,B$, or the diagram $A\,B\,H\,G$, taken to the proper scale.

In doing this work, the piston is supposed to have traveled from position $A\,G$ to position $B\,H$ and, of course, no back stroke in the other direction is supposed to have yet been taken. The total area of this part of the diagram figured, or measured, and taken to the proper scale, will be found to be 425,000 foot-pounds. This is the work done in compressing the air from volume $G\,J$, or 100 cubic feet, to volume $H\,J$ and raising its pressure from atmosphere to 100 pounds gage. Starting with 100 cubic feet and atmospheric pressure, and compressing to 100 pounds by adiabatic compression, the volume of the air $H\,J$ or V_2 will be 23.26 cubic feet.

Expelling the Air from the Cylinder

Let the curve $A\,C$ represent that of isothermal compression. The law of this compression is that the temperature remains constant throughout its entire range, and that the product of the absolute pressure and volume at any point is equal to their product at any other point. Under these circumstances, the volume of the air represented by the length $C\,D$ will be 12.816 cubic feet. In advancing the

piston to position $C K$ from position $B H$, pushing the air out of the cylinder through the discharge valves at 100 pounds pressure, the work done by the piston is area $B C K H$ and is the volume $H K$, multiplied by the pressure per square foot, or $(23.26 - 12.816) \times 114.7 \times 144 = 172{,}500$ foot-pounds. Then the entire work done by the piston from the beginning of the stroke to position $C K$ is $425{,}000 + 172{,}500 = 597{,}500$ foot-pounds.

Work Done by the Atmosphere

The work required to push the rest of the air out of the cylinder into the receiver at 100 pounds gage pressure will be area $C D J K$ and is, by a similar calculation, 211,680 foot-pounds, bringing the total work done by the piston up to 809,180 foot-pounds to compress 100 cubic feet of free air from atmosphere to 100 pounds pressure and force it out of the cylinder and into the receiver. Now all of this work did not come from the motive power driving the compressor, for while the piston has been moving forward, compressing the air, the atmosphere has been exerting a pressure on the back of the piston, of 14.7 pounds per square inch absolute, and helping the piston. The work done by the atmosphere and represented by area $A E J G$ is then the product of the atmospheric pressure and the volume swept through, or 211,680 foot-pounds; which it will be noted, is the same as the work done in area $C D J K$. This leaves the net work done by the motive power of the compressor, 809,180, less 211,680 or 597,500 foot-pounds and this amount of work has actually come out of the coal pile.

The Part Played by Heat

Now that this amount of work is proved to have been done by the compressor let us see what has become of it. At the point B, the air is very hot, due to the compression. Its temperature may be calculated by the adiabatic formula and assuming 60 degrees Fahrenheit initial temperature, we will find 484 degrees Fahrenheit at point B. After the air has passed out of the cylinder and again cooled down to atmospheric temperature, in the pipe line, its volume will have shrunk to the length $C D$, which has already been shown to be 12.816 cubic feet. In thus cooling and shrinking, the air has given out an amount of heat equal to the weight of the air multiplied by its specific heat, and by the difference in temperature. The weight of the 100 cubic feet of free air originally in the cylinder at 60 degrees Fahrenheit is 7.63 pounds and this weight will not have changed, no matter what the pressure and volume, so the heat lost from the air during the process of cooling, after compression, and before reaching the driven machine is $7.63 \times 0.2375\ (484 - 60) = 768$ British thermal units.

In this expression, the figure 0.2375 is the specific heat of air at constant pressure.

A British thermal unit is equivalent to 778 foot-pounds of work, so the amount of work lost by the radiation of the heat of the air is 768×778 or 597,500 foot-pounds.

A glance back will recall that the amount of work actually coming from the coal pile to drive the compressor in compressing and expelling 100 cubic feet of free air, at 100 pounds pressure was actually 597,500 foot-pounds. What could be more convincing than this, that all the work done by the compressing engine has been dissipated in radiation of heat from the compressed air, on the way to the air-driven machine? One thing will perhaps be more convincing. It is this: In compressing 100 cubic feet of free air to 100 pounds pressure in one minute, by single-stage adiabatic compression, the indicated horsepower in the compressing cylinder will be, by the well known formula:

I.h.p. $= 1.511\ P_1\ (R \quad - 1)$ where P_1 is the absolute initial pressure in pounds per square inch and R is the ratio of compression. This gives 18.106 indicated horsepower per 100 cubic feet per minute. Expressed in foot-pounds, thus:

$18.106 \times 33{,}000 = 597{,}500$ or $\frac{597{,}500}{778} = 768$ British thermal units. Thus all signs point to the fact that the work done by the coal pile has disappeared into heat.

It should be further noted that the initial temperature of the air entering the compressor cylinder will not affect the power. A higher initial temperature will result in a higher final temperature, but being warmer, there is a less weight of air admitted to the cylinder per stroke and *vice versa*.

The Real Source of the Power

So far so good, but if all the work has been lost in heat, what drives the pneumatic hammers, drills and so forth? Looking back again at the indicator diagram and remembering that the air after being compressed and cooled, has a volume represented by the length $C D$ or, as has been shown, 12.816 cubic feet, it will be realized that this is the volume of air entering the pneumatic machine driven, and this is the piston displacement of this machine per minute, or during the time that the compressor was compressing and discharging the 100 cubic feet of atmospheric air just considered. As this air is admitted to the driven cylinder at 100 pounds pressure, or 114.7 pounds absolute, the work done on the face of its piston during this time will be the product of the displacement and the pressure acting, or $12.816 \times 114.7 \times 144$ or 211,680 foot-pounds, which is exactly the same as the area $C D J K$, which is also the same as area $A E J G$, which latter, it has been shown, was the work done on the back of the piston of the compressor by the atmosphere.

This now proves that all the work done in the air-driven tool has come from the expansion of the atmosphere, acting on the compressor piston, which is the assertion, the truth of which we have been endeavoring to establish.

Efficiencies

Beyond this is the fact that the whole of this work does not actually reach the tool, and this aside from mechanical friction, which has not been considered at all in this discussion. The further loss of work is due to the fact that on the other side of the driven piston the atmosphere is exerting a pressure of 14.7 pounds absolute, tending to retard it. This work of retardation again amounts to the product of the displacement and the atmospheric pressure, or 27,129 foot-pounds, and this deducted from the work done by the entering air, leaves a net amount of work which, neglecting mechanical friction, actually reaches the tool, of 184,551 foot-pounds.

This is the amount of useful energy obtained from an expenditure of 597,500 foot-pounds of work given up by the compressing engine, or an efficiency of $\frac{184{,}551}{597{,}500} \times 100 = 30.9$ per cent. This is the theoretical "thermal efficiency" of an air compressor and a pneumatic tool, rock drill, or similar device using air nonexpansively at 100 pounds pressure, compressed in a single stage, and does not include pressure drop, leakage or friction losses. These mechanical losses would reduce the practical efficiency to about half of the theoretical value, making the actual efficiency probably about 15 per cent.

If the compression had been compound, to 100 pounds pressure, the theoretical thermal efficiency of the compressor and tool would be 36.4 per cent. and the actual efficiency probably about 18 per cent. This thermal efficiency depends upon the air pressure used, and decreases as the pressure increases. Also the lower the pressure, the higher the efficiency, but in order to do a given amount of work with a low pressure, it would be necessary to increase the size of the driven cylinder, and it has been found that the most commercial sizes, combined with power economy, leakage, etc., demand a pressure between 80 and 100 pounds.

Objection may be made that this discussion is based upon the adiabatic compression curve and so is not practical. The fact is that while the actual compression curve is slightly below the adiabatic, this means that some of the work of the air compressor goes directly into the water jackets as heat, instead of being lost in radiation from the pipe line later. The argument would be the same under these practical conditions, with the actual

temperatures and pressures, for the practical compression curve can be mathematically expressed just as well as the adiabatic, but the explanation and argument would be much more complicated and would lead to the same result.

If compressed air is so wasteful of power, why is it becoming more and more widely used? The answer to this question is that the vast saving in labor cost as opposed to other methods of working, so far overbalances the comparatively low power economy that the latter feature is secondary, and also many things can be done with compressed air that can be done with nothing else.

The power economy of compressed air may be increased by various means: Compounding, expansion and reheating, all of which subjects have been discussed in previous articles.

Snap and Flush Pin Gages

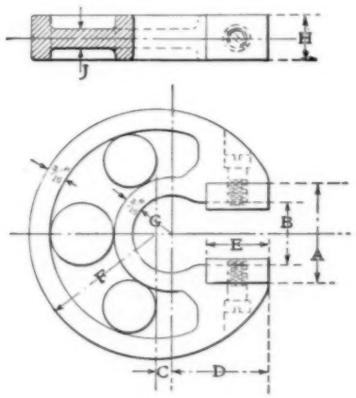
By Walter Clarke

Several forms of handy gages adapted for a wide variety of work, with tables of standards.

Simple design permits casting frames in gates, and reduces machine work in finishing.

Foremen in charge of manufacturing departments and inspecting departments will, I am sure, welcome a set of standards for gages. The standards shown will be found useful for all gaging, not only in the departments mentioned, but all over the plant, for lathe, planer or milling jobs, although they were made in the first place for inspecting interchangeable parts of revolvers and typewriters. The fact that they are very simple in design makes it possible to cast the frames in gates, and very little machine work is required to finish the castings.

In Fig. 1 is shown a very simple snap gage which can be used on round work as well as flat. The deep throat will permit gaging of portions some distance from the edge of the piece. The frame is of cast iron, and after a roughing cut has been taken, the castings are piled out in



No.	Limits	A	B	C	D	E	F	G	H	J	Scr.
1	.25	.50	.30	.07	.75	.44	.85	.25	.38	.20	* 5-40
2	.50	1.00	.56	.15	1.00	.62	1.25	.38	.44	.20	* 10-32
3	.75	1.25	.88	.24	.86	.62	1.25	.48	.56	.25	* 10-32
4	1.00	1.62	1.12	.16	1.25	.75	1.70	.62	.75	.25	⅜-20
5	1.25	2.00	1.25	.20	1.35	.75	1.90	.75	.75	.30	½-20

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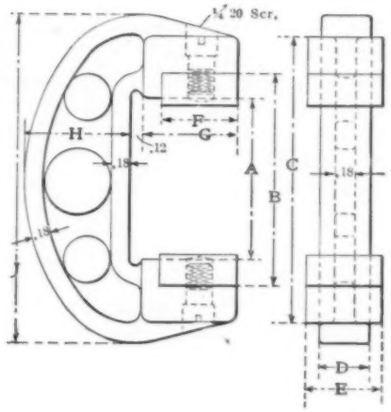
FIG. 1. SNAP GAGE SIZES

the open where they will be subjected to all kinds of weather, for several weeks. In this way the iron is given a chance to "season" before the final cut is taken. Tool-steel blocks hardened and ground to size are secured in position, the thickness of the blocks being made to suit whatever size of pin is to be gaged. Looking at the table it will be noticed that limits are given. We can gage larger work than the sizes given, but it is not



No.	Limits	A	B	C	D	E	F	G	H	J	Scr.
1	1.50	1.60	1.82	2.58	.50	.75	.75	.95	1.06	2.94	¼-20
2	1.75	1.85	2.10	2.86	.50	.75	.75	.95	1.06	3.25	¼-20
3	2.00	2.10	2.32	3.05	.60	.85	.75	.95	1.10	3.42	¾-20
4	2.50	2.60	3.00	3.75	.60	.90	.85	1.10	1.16	3.12	5/16-18
5	3.00	3.10	3.50	4.25	.70	1.00	.85	1.10	1.16	4.62	5/16-18

American Machinist

FIG. 2. SNAP GAGE SIZES

advisable to do so as this would make the steel blocks too thin.

Fig. 2 is another form of gage, starting where the first form stops and continuing to 3 inches. The diameter of a piece can be gaged with the first three sizes, but they are not designed for that purpose.

Fig. 3 is not like the others, in that it is a flush pin gage. This type of gage is very useful in the inspection department, because the average person employed in this department cannot be called a skilled workman. For that reason it is important that the gages should be as simple as possible for the operation. There is nothing new about the flush pin gage, but this is a new application of an old idea. The design is handy because the operator can grasp it in the hand and push the flush pin with the thumb, holding the piece to be gaged in the other hand. Where the ends of the flush pin are ground away are the limits allowed. If the work gages large it is returned to be finished to size and if it is too small, it is thrown away.

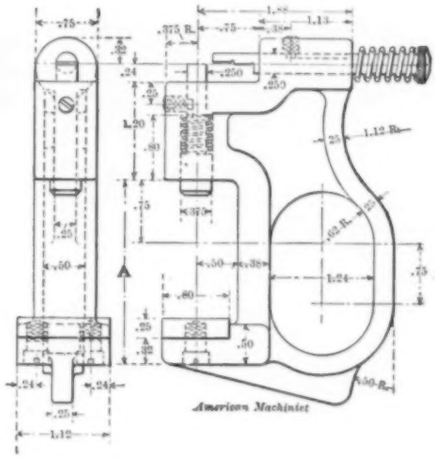


FIG. 3. FLUSH PIN GAGE

These gages are made in several different sizes, the dimension *A* being 2.25 inches in the smallest and ranging by 0.25 up to and including 6 inches, the other general dimensions remaining the same in all sizes. Like the other casting, these are well seasoned before the finish cut is taken. No explanation of how the gage works is necessary, as the line cut explains itself.

Each gage, no matter of what form, is marked with the size, part number and gage number, and the operation drawing will tell the person just where to gage. Each gage is made up complete and no attempt is made to make the parts interchangeable.

According to the *Brass World*, in 1818 the art of gilding brass buttons in England had arrived at such a condition, as far as refinement was concerned, that "three pennyworth of gold," as an early writer has said, "was made to cover a gross of buttons." It was furthermore said that "the experiment has been tried to produce *gilt* buttons *without any gold;* but it was not found to answer, the manufacturer losing more in the consumption than he saved in the material."

Scientific Factory Management

By Holden A. Evans*

Reports, blanks, forms, red-tape methods, clerks do not constitute scientific management.

Such management provides for a careful analysis to determine the work to be done, fixing the best way to do it, employing the best machines and men, and accurately recording the cost.

During recent years shop management has received a great deal of attention from competent engineers and managers. The correct type of management has been widely discussed and much has been written regarding this subject.

On one hand competent engineers who have studied the subject for years recommend a system of management which largely increases the number of nonproducers and greatly increases the cost of management. These engineers claim that the increased returns will pay many times over for the increased cost of management.

On the other hand, some managers of large successful establishments assert that the detail methods advocated by these engineers will wreck any private establishment. I have been told that some have even asserted that these methods, if applied to Government establishments, will bankrupt the Government!

The term "scientific management" is now generally accepted as referring to the type of management advocated by Fred W. Taylor and those who have been associated with him. In some quarters there is much opposition to Mr. Taylor's detail methods, and if an engineer advocates what he terms scientific management, he encounters this opposition.

Under these conditions it seems that it is high time that scientific management should be defined. It also seems desirable to ascertain, if possible, the causes of the opposition manifested toward scientific management.

What Is Scientific Management?

Is scientific management the use of a lot of reports, blank forms, and red-tape methods, employing an army of nonproducers, who increase the overhead expense and produce no adequate return? If so, it is a fraud parading under the attractive name of scientific management. Or is it a scientific treatment of an important industrial problem? I approach this subject with hesitation. I well know that the commercial world considers Government methods grossly inefficient. I realize that generally speaking the commercial world is correct in its estimate. There are few managers and engineers in the commercial industrial world who know that many Government officers have studied the principles of good management, and are striving—yes struggling—to apply them.

If scientific management be properly defined, this definition can be applied to the various forms of management in use, or that may be proposed, and the bogus and real determined.

It is believed that the definition submitted will meet with the approval of the majority of engineers and managers.

Scientific management is a form of management which provides for the following:

First. A careful analysis to determine exactly the work to be accomplished before the work is undertaken.

Second. The determination of the best way to accomplish the work in the quickest time at the lowest cost.

Third. The employment of the best machines, best facilities, and best men available to carry out the work in the best way, as previously determined.

Fourth. An accurate record of the cost of the work.

No doubt many managers who read this will smile and exclaim that there is nothing new in this definition. They consider the principles laid down so simple, so elementary, so plain to everyone, that they are surprised at anyone writing on this subject. They are amused that anyone should apply the high sounding term "scientific management" to what is nothing but good management. They are satisfied that their establishments have been managed for years in accordance with these principles. These are correct that scientific management is nothing more than good management. Are they correct that this is the system of management generally followed? I am satisfied that the majority of ship yards, machine shops, foundries, etc., throughout the country are not managed in accordance with the principles enunciated in the definition of scientific management.

Why Is Scientific Management Opposed?

There are many who believe that the so called scientific management is nothing but red tape with numerous written reports, many blank forms to be filled out, an army of clerks and other nonproducers, and no tangible results in increased profits.

These see only the means for accomplishing an end. The machinery only is seen; not the finished product. The machinery looks complicated; it attracts attention, and many mistake the machinery for the product. The machinery is only incidental; *it* is not scientific management; it is only the means for securing scientific management. If it is too complicated, if there is a single report, a single form, that is not necessary to secure the results required, the unnecessary complication, the useless blank should be eliminated.

There are some who have had experience with so called organizers who have promised to obtain wonderful results from their reorganization within a few months. They have left disorganization in their trail. These parade under the cover of scientific management and bring discredit to the name. It seems strange that experienced managers should be fooled by these so called engineers. Anyone who claims to be able to reorganize a plant and obtain results in a few months, is a fakir, nothing less.

There are managers of the old school who believe in the "good old-fashioned way." These know nothing of scientific management and they have little patience with those who advocate changes in methods. Why do these managers tolerate a a drafting room or a designing staff? Why not return to the good old-fashioned rule of thumb methods and the drafting work done by the superintendent and foreman on the floor of the shop? There is just as much reason for this as for the antiquated shop methods. Just as much money can be saved by scientific methods in the shop as has been saved by scientific methods in the design work.

Strange to say that there are some who believe that industrial management is so simple that those who have had no experience are competent to successfully manage large establishments.

Under these conditions it is not remarkable that the progress of scientific management is slow. If the aims of those who advocate scientific management were more generally known much of the opposition would disappear.

It is not expected that many of those of the "old school" will be converted, but this class will disappear before many years have passed.

It is not expected that the small class which believes that amateurs can successfully manage large industrial establishments will be converted. The ignorance of this class is as great as the vanity of the amateurs who undertake the management. The inevitable collapse of these establishments will settle the fate of this class.

Scientific management is nothing more than a strict application of the principles of good management. The details must be made to suit the requirements of each case. There can be no standard form, no hard and fast rule. Each problem must

*Naval constructor, United States Navy.

be carefully studied, and the methods made to fit the requirements. When the industrial world learns that this is the scientific management advocated by engineers, there will be no further opposition.

Are the Principles of Scientific Management Generally Followed?

Does the good old fashioned way accomplish the results called for by the definition of scientific management? It most assuredly does not. Does the system of management usually followed accomplish these results? Let each manager or owner apply the definition to his shop and answer the question for himself.

Is a careful analysis made of the work to be accomplished before the work is undertaken?

In new work drawings are supplied, and in manufacture work these are usually in great detail. Frequently, however, the so called drawings are merely outlines which are given to a workman with a few general instructions. The workman has to study out the details and in many cases has to make detail sketches from which he works. Is he best fitted for this work? Is it economical to employ him on this class of work? Certainly not; yet it is done in many establishments, some of which are large concerns. Frequently the workman encounters a difficulty which he cannot overcome. He wastes much time vainly trying to find a way out, and is finally forced to go to the foreman for information. The foreman is engaged with other duties and it may be some time before he can give the question attention. Perhaps the foreman cannot solve the difficulty, and he too wastes time trying to do so, and is finally forced to go to the drafting room which should have supplied the information in the first place. In repair work it is the exception that a careful analysis is made of the work to be accomplished before the job is undertaken. The general trouble is, of course, known, but the actual work to be accomplished is not determined before the work is begun. The general rule is to assign the work to a competent mechanic with general instructions. The workman then begins to tear apart and he himself decides on much of the work. Soon, however, he strikes something that he cannot settle himself. He tells the foreman of this and the job is held up until a decision is reached. Often the foreman does not care to make a decision and he refers the questions to the superintendent. The latter has many such questions to decide and many other duties. It may be several days before the workman gets definite instructions. In the meantime the job is dragging or is actually held up. When work is carried out in this manner, the machine work is done as it develops, castings or forgings are ordered when it is found that they are needed and material is not ordered from store until the workman actually requires it to proceed. This procedure causes delay after delay; the workman keeps himself busy somehow to keep from attracting attention; if the foreman sees that nothing is being accomplished while the workman waits for machine work, forgings, or material, he may take the workman off of the job temporarily, until the material arrives. The chances are that the workman will successfully kill time until he can proceed.

If a record were kept of the time spent by this workman in hunting for information and hunting for tools, and the time wasted waiting for machine work, castings, forgings, and other material, it would be found that this time in many cases actually exceeded the time required to do the work. Under management of this kind, no such records are kept. If the large final cost of the job attracts the attention of the manager, he cannot discover where the money has gone. He knows that the cost is far too great and when he takes the foreman to task, the blame is placed on the workman, who may be a competent, hard-working mechanic. It is not his fault; it is the fault of the system under which he is working. Every superintendent and foreman will deny that such faults exist; each will state that there are no delays of this kind. Let the owner or manager take a few days off and spend all of the time in the shop and follow up the jobs, and convincing proof will be found. These conditions are bound to exist; they cannot be avoided under the system of shop management usually employed. It must be admitted that the work to be done must be accurately determined by someone. Is it best to have it determined by the workman as the work progresses? Is it profitable to employ a mechanic on the work in this manner? Surely not. If the work to be accomplished must be determined, the logical way, the scientific way, is to have this carefully done before the job is started. If it is necessary to entirely dismantle a machine to discover what is to be done, do this before you start men on the job proper. Tear down the machine, have competent men determine exactly what is to be done, order material, castings, and forgings and the necessary machine work, and do not start the job until this is done.

Is the Best Way of Doing the Work Determined Before the Work Is Begun?

The second requirement of good management naturally follows the first; it cannot be applied unless the first has been followed. After the work to be done has been determined, the best way of doing the work should be determined. There are very few shops where any effort is made to determine the *best* means for accomplishing the work. Frequently the job takes care of itself. The mechanic who has the job decides in many cases the methods to be followed. Fred W. Taylor has gone into this fully and has clearly shown that it is impossible for the mechanic to determine the best feed, depth of cut, and speed in machine operations. Mr. Taylor has proved the enormous savings that can be effected by having these determined by someone who is competent to do this. At present I do not refer to the detail machine operations. This ground has been fully and ably covered by Mr. Taylor. What consideration or thought is given in many shops to the class of machine to which the work should go? In many shops this receives but little attention. The work is often assigned to a machine because the operator at that machine is nearly out of a job. Go in the majority of the shops and spend a few days and see how many jobs there are that are incorrectly placed.

Not long ago in a shop under my supervision I noticed that frames for watertight doors were faced on a planer. I suggested to the foremen that they could be done more quickly on a slab milling machine which was idle. He assured me that this had been carefully considered. This is the answer you expect and it is the one you will always get. The job was changed to the slab milling machine and the time was cut in half. The selection of the proper machine for the work is only one of the important elements of the determination of the best way of accomplishing the work. The sequence of the operations is of much importance. In many shops these questions receive little consideration. In the great majority of shops the shop is run by a foreman and a few assistants, the number depending on the size of the shop. These assistants are called from job to job as trouble develops and often several jobs are waiting for the assistants. Nothing is schemed out ahead, the assistants are worked to their limit and only give their attention to jobs which require immediate attention. They can do no more. To accomplish the best results it is essential that the best way of accomplishing the work should be determined before the work is undertaken. There is much difference of opinion as to how far this determination of the work should go. Some advocate that every minute detail should be settled and detailed written instructions should be given. It is difficult to prove which is the better. No doubt the detail method is the more scientific. This method, however, requires a very large staff, the cost of which is great. Those who oppose these methods claim that the cost of the staff is greater than the saving effected, while those who have tried these methods resist this claim. As scientific methods are more largely used, experience will settle the claims of these two views.

The determination of the best general

methods for each job, with careful routing of the work, and written general instructions is a tremendous improvement over present methods. This system can be expanded as found necessary, and eventually I believe that the detail method will prevail.

Are the Best Facilities Provided? Are the Best Results Obtained?

The third element of scientific management includes the handling of men, and the use of methods which will secure the maximum output from workmen. This at once leads to consideration of the various means of paying men, whether by day's wages, piece work, the bonus system, or the Halsey premium plan. This part of the subject has been widely discussed, and as practically all managers are well informed as to the advantages and disadvantages of the various systems in use, no attempt will be made to discuss this part of the subject.

It is my experience that one of the most frequent causes of the excessive cost of work is the poor condition of machines and facilities. A careful examination will, in many cases, show that machine tools are not in the best condition, belts are poor, the supply of hand tools is inadequate, and facilities which would greatly reduce costs are lacking.

In a large establishment which I recently visited, I noted that drills, reamers, etc., furnished the workmen were not in good condition. I questioned one of the men and he told me that it was the exception to get a good tool from the tool room. In the tool room I found that no inspection was given the tools when returned other than that given by the laborer who received them. Unless a tool was broken, or the edge completely gone, it went back to the racks for reissue. A casual inspection showed the tools in the racks in bad condition. These tools were issued to high-priced mechanics and they were expected to produce results. The men worked at "day's work" and it did not matter to them. Piece work would have opened the eyes of the management to the condition of the equipment. The assistant foreman in charge of the part of the shop in which the tool room was located and consequently (in that establishment) in charge of the tool room stated that when the men employed on the grinders ran out of a job, they went over the tools stored in the racks and "touched them up." Could one believe these conditions possible? This was found in a large establishment which employs several thousand workmen.

Is an Accurate Record of Costs Kept?

No attempt will be made to describe a cost-keeping system, as this is a very large subject in itself. I simply desire to suggest to some managers the questions: Does your system provide an accurate record of the cost of your overhead expenses so divided that each month you can put your finger on the leaks in the operating expenses? Does it provide for a proper distribution of the overhead burden? In many of the large manufacturing establishments, this subject has been well studied, and systems are in use which leave little to be desired. In the thousands of small jobbing concerns, however, little attention has been given this subject and there is so little knowledge of overhead expense and its relation to the total costs that many small concerns unknowingly do work for less than cost. Many of these concerns fail and the owners do not know the cause. Many managers who have accurate cost-keeping systems and know their costs, are forced to compete with those who do not know. The latter, in ignorance, frequently take work at less than cost until forced out of business, only to be replaced by another concern who does the same. This is demoralizing to business and it is to the interests of all that these small shops should have a better understanding of real costs. There are also some large establishments engaged in jobbing work where little attention is given real costs.

I know of at least one large establishment operating a number of shops, including wood-working shops, foundry, machine shops, pattern shop, electrical shop, blacksmith shop, structural-steel shop, pipe shop and boiler shop, which does not obtain accurate costs. In this establishment there is one shop expense which is prorated to all work on the basis of direct labor, notwithstanding the fact that in one shop the overhead expense is 100 per cent. and in another it is 40 per cent. This establishment repeatedly loses work on account of this system of accounting. When called upon to submit bids on work which would be done in shops where the overhead expense is low, the higher average is employed and these bids cannot compete with those of a rival where costs are accurately figured. With keen competition, the knowledge of actual costs is essential to the successful management of any business; a cost-keeping system which fools the manager or owner is far worse than no system. Yet this is what is accomplished by the so called cost accounts of many establishments.

It Is not a Simple Problem to Follow the Principles of Good Management

If owners and managers will be honest with themselves and carefully examine the operation of their plants the great majority will find that the essential requirements of scientific management are not met. It must be admitted that these requirements are essential. Practically all are willing to accept these principles. Then why not enforce them? Because when the owner or manager really studies these principles as applied to his business he soon sees that it is not a simple problem to carry them out; he sees that it will require a complete reorganization of his staff to do this. He sees that he will require much expert help to make the changes necessary and that he will require a large staff to carry on the work after the changes are made. This will cost money—in some cases a great deal of money. He is now making a reasonable profit; he wonders if he will really get an adequate return for the money that he will have to put in the change. He dislikes changes anyway and this change is one which will involve calling in outside help, actually turning over for the time being the control of a large part of the management to an outsider. This will cause friction and opposition from many of his permanent staff. He is afraid it is not worth while. It requires courage and the strength of his convictions to make a change of this kind. If he consults with his staff every argument will be used by these to prevent this change. They consider it a reflection on their management. They see trouble and perhaps danger ahead for themselves.

Before making the decision that it is not worth while, let him make some careful investigations. The manager is probably an able man who has had much shop experience himself. He has risen on account of his ability. For a number of years, being a competent manager, he has not been devoting his time to details. He has been occupied with the big affairs of management and has only been dealing with the exceptions in the shops. He needs a holiday, but—don't take it this year in the mountains. Turn over the management to the assistant as if he were going to the mountains for a month; then go into the shops instead. Don't let him concern himself with the management; don't let him be drawn into it. This will be hard but for the success of the plan I propose this is necessary. He is no longer the manager but is a shop expert making a critical examination of his own plant.

Select a job in progress—preferably a repair job which is being done without plans. Take this job and study it from beginning to end. No doubt the foremen and assistants will give the greater part of their attention to this job, but that will make little difference. He will find delays, lack of facilities, waits for material, poor methods, lack of proper information for carrying on the work, and he will see on every side where money can be saved. Take a new job in progress, follow it from the raw material to the finished article. Find out when the material was ordered, who ordered it, how he got his information for ordering. Find out how the material was obtained from the storehouse, when it arrived in the

shop and what is the next step. Study each of these details, get *all* of the facts. At each step study to see what improvement can be made. Follow this job through the shop—department to department—shop to shop—in the same manner. No matter if every foreman and assistant are concentrating on this job, he will find enough lost money to open his eyes.

At the same time watch what is happening with the other jobs while the foremen are concentrating on the particular jobs which he is analyzing. Examine the machine tools and find out in detail how they are kept up. Examine closely the condition of the belts and find out who is responsible for their condition. Take a machine at random, put in some high-speed tool steel and put on a test, using cut, feed, and speed which he knows should be possible. See if the belt will pull it. See if the machine is in condition to stand the test. Examine the castings that come from the foundry to see if the patternmaker has not provided too much finish. See how this finish is removed; see if on brass castings more cuts are made than are required. See if unimportant dimensions are marked on the drawings. Isn't it a fact that men at machines are taking as much care to finish to unimportant dimensions as to important dimensions and that this involves extra cuts where it makes no difference if the dimension is ⅛ or even ¼ inch greater than given on the drawing? Examine carefully the small-tool equipment; take out the tools from the racks in the tool room and examine their condition.

I sincerely hope that some of the managers of our large shipyards will take the holiday suggested.

If the holiday suggested be taken, I am satisfied that before two weeks have passed many managers will be in the discharging mood. Many will be ready to immediately find new foremen. It is not the fault of the foreman; it is the system. Go to the root, don't scratch on the surface. The best foreman on earth could not produce the best results with the system. The system must be changed. Scientific common-sense methods must take the place of the haphazard, go-it-blind methods now followed. After his holiday, the manager is satisfied that something should be done, he sees that enormous reductions in cost can be made.

What Will the Manager Do?

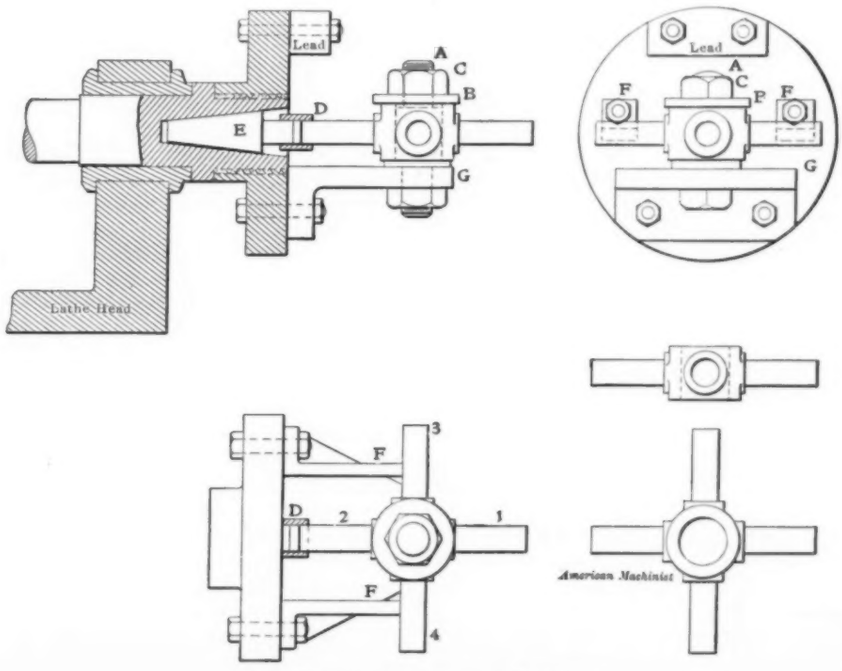
He claims that he believes in the principles of scientific management, but he fully realizes that to rigorously follow these principles will require a revolution in his establishment. He does not want such a revolution. He does not wish to bring an outside expert in his plant. He, perhaps, has been told that such an expert will entangle him in endless red tape. He fails to see that the so called red tape in forms and reports is but a means of accomplishing an end. The most probable reason, however, for not employing an expert is that the manager himself is an able man. He sees the improvement that is possible and he knows that he himself can make marked reductions in cost. No doubt he can do so if he will resign as superintendent or manager and give his whole attention to the job. He cannot accomplish the results as well or as quickly as the expert organizer or production engineer but he can make a wonderful improvement. What manager or superintendent will do this? Not one; he will endeavor to bring about the results and at the same time carry on his regular work. No man can do this. No doubt when his eyes have been opened he can and will make improvements in spots, but general improvement is very slow and as for obtaining the very best results it is impossible. It is a scientific question and must be handled as such.

Machining Crossheads for Autos

By H. F. Cherry

Having a large quantity of crossheads to machine for automobiles, it was necessary to make a special turning fixture so that the arms should be at right angles to each other and meet the axis of the hole in the center of the piece. The work can be finished in the capstan or ordinary turning lathe.

An angle plate *G* was fixed to a faceplate, and in this was fitted a stud *A* with a collar of a fixed thickness, to allow the crosshead to rest in proper position for the machining of the arms in the correct relation to the face of the hub.



THE CROSSHEAD AND THE FIXTURE

The operations are as follows: First operation: Place the crosshead on the stud, true up arm No. 1 as near as possible, then proceed to finish it to size. Washer *B* is hardened and acts as a gage.

Second operation: Loosen nut *C*, turn the crosshead until arm No. 1 is turned into position of No. 2. A small bush *D* placed on a specially prepared center *E* is made to slide on to the turned arm, No. 1, as shown. This insures the two arms being in perfect alinement, and true to the axis of the hole in the crosshead. Operations of machining are the same as in No. 1.

Third operation: To machine the third arm, there are two angle brackets as shown in plan. These must be accurately made to length. They are swung into position (as shown in the end view), to allow the third arm to be machined.

Fourth operation: Same as No. 3. The lead weight is to balance the angle plate. This fixture was found to give accurate results, and did the work in good time. While we have accomplished these operations by other methods, this fixture seemed to give the most satisfaction to all concerned.

Rigging up to Make a Spiral Sleeve

By F. W. Lawson

In the absence of a universal milling machine with spiral attachment special fixtures were rigged up on the planer.

How the various operations were accomplished with improvised methods.

A spiral sleeve for the U. S. S. "McDonnough" was to be made, and as there was not available a universal milling machine with a spiral attachment, I got up the rigging shown in the accompanying sketches and made it on a planer. The sleeve is of manganese bronze and has a left-hand quadruple thread on the inside and a right-hand quadruple thread on the outside. The lead of both inside and outside threads is 33.5 inches.

Rigging Up to Make a Rifling Bar

The first operation, Fig. 1, was the planing of a left-hand spiral groove in a machine-steel bar, the same pitch as the inside of the sleeve, for a rifling bar. The inside of an old spiral sleeve *A* was used as a guide to cause the bar to rotate as it passed to and fro, and the sleeve was supported rigidly over the center of the planer table so as to clear the table. My idea in supporting the sleeve over the table was to fasten blocks to the floor and let them come up on either side of the planer high enough to receive the iron cross pieces. J. F. Lannigan, a leading man, suggested fastening two plates *B B* to the frame of the planer in place of the blocks. The plates were designed and used by him.

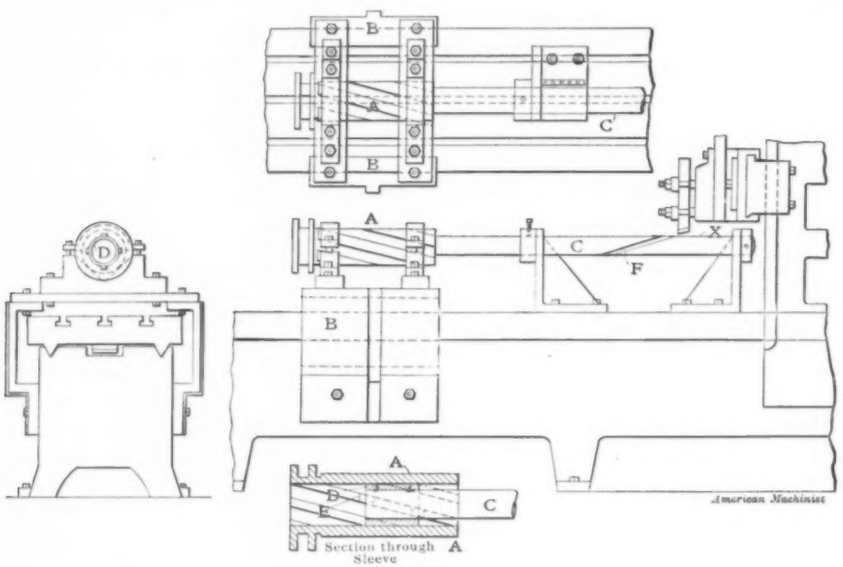


Fig. 1. Planing Spiral Slot in Cutter Bar Using Old Sleeve as a Guide

The three views in Fig. 1 show how the sleeve was supported by means of plates *B B*, two wrought-iron cross bars and two V-blocks, in which the sleeve was secured by circle clamps. Bar *C* was supported by two angle plates bolted to the planer table, with a hole bored in their perpendicular faces to a working fit for the bar. Two collars were fastened by set screws on the bar and against the faces of the angle plates, thus the bar was allowed to rotate, but was held against end movement in the angle plates. To the other end of the bar, as shown in the sectional sketch, Fig. 1, was fitted a bushing, which was fastened with two set screws. The outside of the bushing was made a sliding fit in the sleeves and fitted with a feather, which was a sliding fit in one of the spiral grooves of the sleeve.

Cutting the Groove in the Bar

The rigging being completed for this operation, the tang of a file was ground to a sharp point and the file fastened in the tool post and set centrally over the bar. The tool post was run down until the point on the file tang touched the top of the bar. The belt was pulled by hand and as the bar traveled underneath the point of the file, a spiral line was scribed on the bar. This line was the center of the groove, and from it holes were laid off and drilled at each end of the travel and the clearance for the tool to enter and stop at was chipped.

The extreme travel in this case was the distance the planer table could travel in either direction without the bushing *D* running entirely out of the sleeve *A*. After the clearance was drilled and chipped, the bar was put back in place for the planing of the spiral groove *F*. As the planer table traveled to and fro, the bar, of course, rotated while it was traveling endwise and during this motion the spiral groove was planed with a tool similar to that used in planing a keyway in a shaft. After the groove was finished the end of the bar marked *X* was turned down and threaded.

Operation on the Valve Shaft

The second operation was the straightening of the threads or spiral lands on the valve shaft *G*, Fig. 2, which had worn taper on the side and at the bottom. A part of the first rigging was used in this operation.

A flanged coupling was fitted on the threaded end of bar *C* and drilled to match the holes in the flange of valve shaft *G*. The couplings were then bolted together. The bar and valve shaft were supported by brackets and an angle plate which were bored out to a working fit for the bar and valve shaft and bolted to the planer table. The bearing in bracket *H* was made in halves in order to admit the journal of the valve shaft. It was faced off on one side, leaving a boss which rested against one of the crank webs of the valve shaft. The angle plate at the end rested against a shoulder to take the end thrust in the other direction. Bracket *I* was supported over the center of the planer table by means of the plates *A* and the wrought-iron bar described in connection with the first operation.

The Bushing and Worm Wheel Attachment

The sectional view of the bracket *I*, Fig. 2, shows bushing *J* bored for a sliding fit on bar *C* and turned on the outside for a working fit in the bucket. In the center of the outside of the bushing was hobbed a worm wheel, the hobbing being done in a lathe with a U. S. standard 1¼-inch master tap. Bolt *K* was threaded in a bolt cutter with 1¼-inch dies and was used as a worm to rotate bushing *J*. The nuts on the bolt were adjusted and jammed together to take up the end play. Two wrought-iron plates were bolted on either side of the brackets to prevent end movement of the bushing and at the same time put tension on it. A feather was fastened in the bushing, which was made a sliding fit in the spiral groove of bar *C*. One face of bushing *J* was quartered by drawing lines on it with a surface gage in a milling machine. These four lines were used to accurately quarter the threads on the valve shaft when planing down their sides. The worm and

worm-wheel attachment for bracket *I* was used to rotate the bar *C* and valve shaft *G*, while the bottom of the threads on the latter was being planed.

The stroke of the planer was adjusted and as the table traveled to and fro with bar *C* and valve shaft *G*, they were caused to rotate by the spiral groove and the sides and bottom of the threads on the valve shaft were planed parallel with the tool.

A Rifling Operation

The third operation was to rifle the four threads in the new spiral sleeve *M*, Fig. 3, to a sliding fit on the outside of the spiral end of the valve shaft.

The new sleeve was fastened to the planer table by means of the two V-blocks and circle clamps. The tool block in this operation was taken off and wrought-iron plate *N* was clamped up in its place to carry the end of bar *C*. The bar, as held, could rotate but not travel endwise. The bar was supported over the planer table and in line with the inside of the sleeve by the two brackets *H'* and *I*, in which it was a sliding fit, as already described.

The cutter head *O* was fastened to the bar with four fillister-head screws. It was fitted with four cutters 90 degrees apart, one for each spiral groove on the inside of the sleeve. The inner ends of the cutters were beveled as shown in the detail sketch *O*, to suit the cone point on the screw *P*, which was fitted in the center of the cutter head. The screw was long enough to project through the sleeve when the cutters were drawn out at the other end. At this point the set screw was turned the desired amount by means of the lathe dog to feed all four of the cutters out to take the next cut. A guide *Q*, shown in detail, Fig. 3, was fastened to the bar just behind the cutter head with a set screw. A flange shown by the dotted lines in the sketch projected over the cutter head and between the cutters, four notches being cut in the guide to allow it to clear the cutters. The outside of the guide was made a sliding fit in the sleeve *M*.

When the planer table was operated it carried the work *M* and the two brackets *H'* and *I* with it; at the same time the cutter bar was rotated by the feather in the bushing in bracket *I*, which engaged in the spiral groove in the bar. In this way the four spiral grooves between the threads were cut. The cutters were not as wide as the finished spaces, therefore several cuts were taken. With this rigging the planer was operated similarly to a rifling machine.

Grooving Another Tool Bar

The fourth operation was the planing of a right-hand spiral groove in a machine-steel bar to the same pitch as the outside of the old spiral sleeve, to be used as a rifling bar. A portion of the rigging used in the first and second operations was used in this operation which is represented in Fig. 4. The outside of the old spiral sleeve *A*, was used as a guide to rotate the bar while the groove was being planed.

Each end of the sleeve was bushed and it was fastened to the bar by means of two set screws. The holes were drilled and tapped through the sleeve and bushings to allow the set screws to be set up against the bar, as it was essential that the sleeve should not be allowed to move on the bar.

The two thrust collars were taken off of the sleeve for this operation in order to get as much stroke of the planer table as possible. They were screwed on the end of the sleeve and were easy to remove.

The bar *R* was supported over the planer table in the manner shown, so as to be rotated by the sleeve when the table was operated, one of the spiral grooves in the sleeve being engaged with a guide *S*, which was supported over the center of the planer table by means of plates *B B*. This guide or feather was made long in order to get travel enough out of the planer table to plane half of the desired length of the spiral groove at a time. The method of operation will be clearly seen in Fig. 4. It will be noticed that the bar and sleeve are held endwise between the brackets by a shoulder

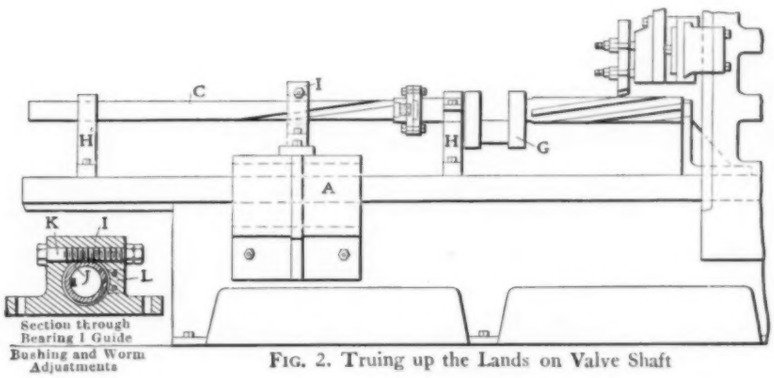


Fig. 2. Truing up the Lands on Valve Shaft

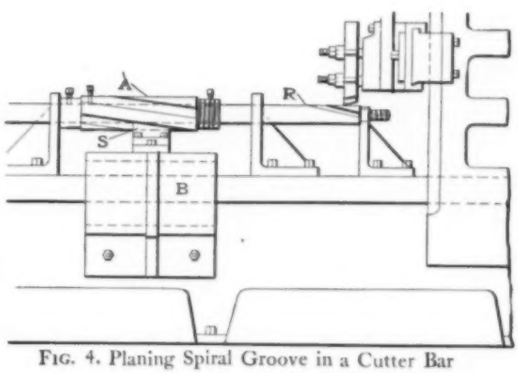


Fig. 4. Planing Spiral Groove in a Cutter Bar

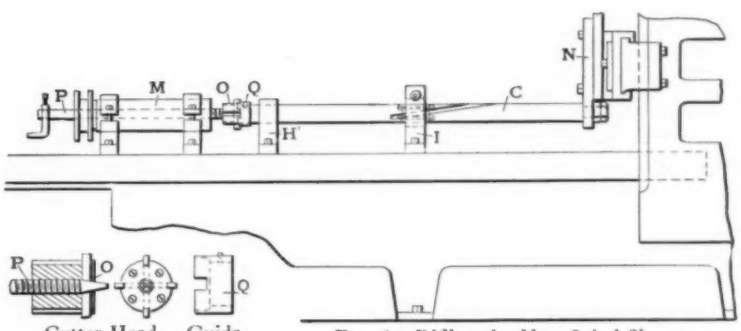


Fig. 3. Rifling the New Spiral Sleeve

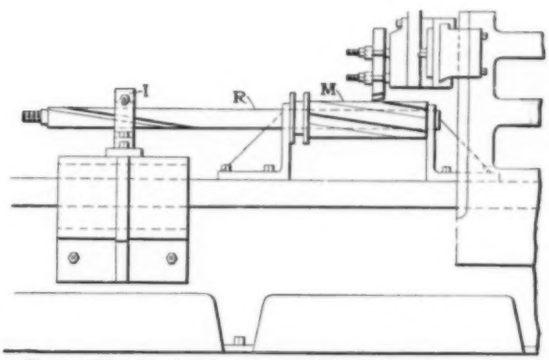


Fig. 5. Planing Lands on Outside of New Sleeve

American Machinist

Operations in Making a Spiral Sleeve

at one end and a collar between the outer end of the sleeve and its bracket.

Another Rifling Job

The fifth operation was to re-rifle the sides of the threads inside of the thrust sleeve which had worn taper from use. The spiral sleeve referred to works inside of this thrust sleeve, hence the removing of the taper on the sides of the threads inside of the thrust sleeve was necessary to insure a good working fit.

The fifth operation is not shown, as it was identical with the operation of rifling the threads on the inside of the new spiral sleeve except that the bar with a right-hand spiral groove was used instead of the one with left-hand spiral, and the clearance on the cutters was reversed; also another feather had to be fitted in the guide bushing to run in the right-hand spiral groove in the bar.

Finishing the Outside of the Sleeve

The sixth and last operation was the planing of the right-hand threads on the outside of the new sleeve *M*, Fig. 5, to a sliding fit in the threads in the thrust sleeve, not shown.

Two bushings were fastened on the bar *R* with set screws, the outside of these bushings being turned off for a driving fit in the new spiral sleeve *M*. The bar was supported over the planer table by means of the two angle plates which have been described.

They were bolted to the planer table with their faces resting against the ends of the sleeve, which prevented end play of the sleeve and the bar. The bracket *I* was supported over the center of the planer table by means of the two plates *B B*, and was bolted to the cross bar over these plates. As the planer table traveled to and fro, carrying the new sleeve *M*, and bar *R* with it, the bushing in bracket *I*, resting in the spiral groove of bar *R*, caused the bar and sleeve *M* to rotate, and during this movement the spaces between the threads on the outside of the sleeve were planed.

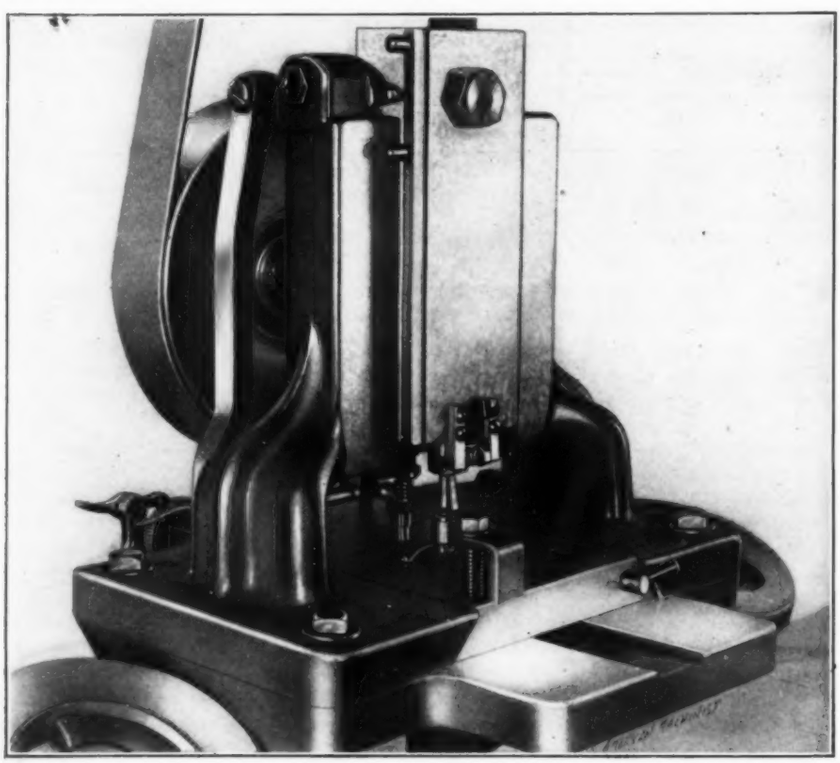
The planer tool was much narrower than the spaces and several cuts had to be taken down to nearly the full depth. After the sides of the threads had been finished, the tool was fed down to the correct depth and then the bar and sleeve were fed around by means of the worm and worm-wheel attachment of bearing *I*, Fig. 2.

With this rigging the work was successfully completed.

New Automatic Slotting Machine

The accompanying halftone shows a new automatic slotting machine, designed and patented by B. F. Stowell, of the Hendee Manufacturing Company, of Springfield, Mass. Two of them have been in use in this establishment for the last three years for slotting keyways in gears, sprockets and flywheels in the manufacture of the Indian motorcycle, producing 60 per hour as an average for the day's run, with ¼-inch slots.

A wide range machine in which the slide is gibbed in the bed of the machine and used as a holding fixture for work.



Automatic Slotting Machine

It will be noted that the slide, below the tool, which is gibbed in the bed of the machine, is used as a fixture to hold the work. This slide, by the turning of the small handle in front, can be at once released and removed, to be replaced by any other slide or fixture designed to carry other work. Both the feed and relieving of the tool are accomplished automatically by the motion of this slide. The curved plunger rod shown at the left of the main frame has a vertical reciprocating motion, which is transmitted by means of a cam-shaped end, to impart a horizontal reciprocating motion to a feed bar, which in turn transmits this reciprocating motion to the work slide. At the same time the ratchet and pawl shown at the rear, in connection with a screw on the feed bar, serve to advance the work slide automatically, a distance equal to the feed desired, where the tool is in its upper position. In this way it is seen that the slide advances to feed the work to the tool in intermittent steps, between which there is a short reverse motion to relieve the work from the tool, during the upward stroke of the latter.

In connection with the feed there is an automatic stop which may be set for any predetermined depth of cut, and the work which it is doing in its everyday operation is gaged to 0.001 inch. Vertical motion of the tool head is produced by a crank and connecting rod, operated from the shaft.

Bench space occupied by the machine is about 14 inches square and it stands about 16 inches tall, weighing about 150 pounds. This size machine is designed for maximum width of slot of ⅜ inch.

Machining Aluminum Crank Cases

Editorial Correspondence

A series of operations on the aluminum crank cases for the engines of the Buick automobiles.

Fixtures and tools used to secure large output by most rapid methods.

In the Buick Motor Company's works at Flint, Mich., every effort is being extended to turn out as many finished automobiles as possible this season, and it is therefore, interesting to watch the different operations on the aluminum crank cases for their engines. Numerous ways and means have been devised to get a large output and at the same time obtain the necessary accuracy in the numerous machining operations. The machines have been located so that the work can be passed from one to the other without any unnecessary handling. Thus the cases, which are made in two halves that are split longitudinally along the crank shaft, are brought in at one end of this department and sent out at the other.

Facing Top and Bottom of Case

The first operation on the case is shown in Fig. 1. This is performed on a three-head milling machine. The two side heads only are used to surface off the top and bottom of the upper half of the crank cases shown in the jig located on the platen of the milling machine. The rough casting is fastened to the far side of the jig. This is run through the machine and the bottom, or surface to which the lower half is bolted, is machined.

After this the platen is run back and the casting transferred to the other side of the jig; a fresh case is put on the far side, and the two cases are then machined, one on the top and one on the bottom. This is the case with all the crank-case castings, after the first one has been machined on the bottom side. As the engine cylinders fit into and their flanges over the four large holes shown in the top of the case, the distance from the center of the crank shaft to this surface must be exact. Two bolts are all that are necessary to tighten and loosen when setting these cases in the jig.

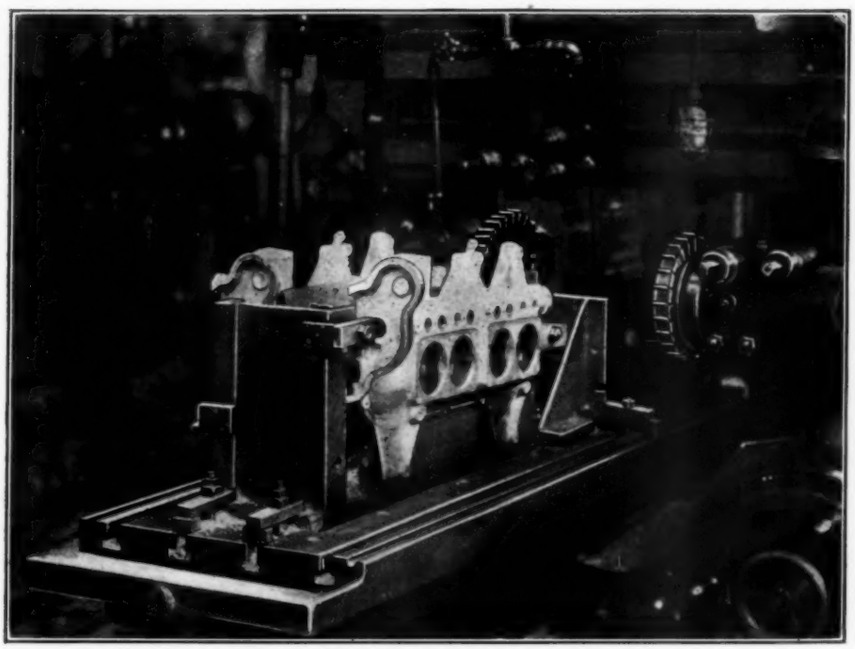


Fig. 1. Milling Top and Bottom of Upper Half

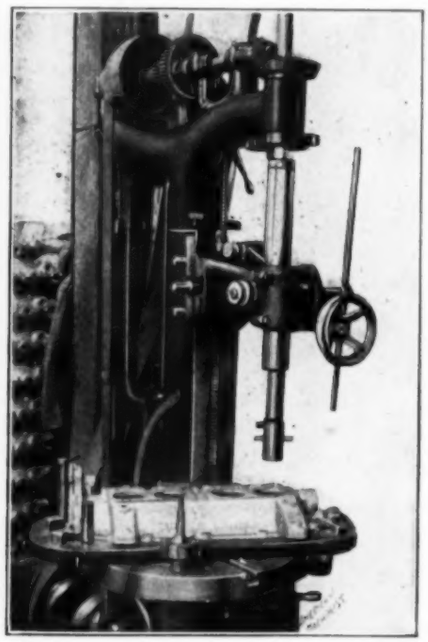


Fig. 2. Boring Piston Openings

Boring Engine Cylinder Holes

The second operation is that of boring out the holes for the engine cylinders to fit into, as shown in Fig. 2. After this operation all the other jigs are made so that they will fit these holes and all other dimensions are consequently taken from them. On the jig the case is located by the crank-shaft bearings in each end and these are still in the rough. These four holes must be exact in size, alinement, and distance between centers. After this operation the case is machined on both ends by machines that are not shown.

The next operation is that of drilling the holes in the bottom of the case for bolting the two halves together. This is shown in Fig. 3 as it is being done in a multiple-spindle drill press. In the jig which is plainly shown, the top lifts off of the four corner posts when taking the drilled case out and putting an undrilled one in. The large holes bored in Fig. 2 fit over bosses located on the bottom plate of the jig.

Machining Valve Rod Holes

After this the case is taken to another multiple-spindle drill press as shown in Fig. 4, where the eight valve-rod holes are drilled to the holes in the jig, shown on top of the case. This jig fits in the holes that receive the engine-cylinder castings. This brings them the right distance from and in line with the cylinders.

After the several other holes in the case have been drilled and tapped the case is taken to the machine shown to the right of Fig. 5, where the valve-rod holes are reamed to an exact size, distance from, and in alinement with the cylinders.

Boring Crank and Cam Shaft Bearings

The most important machining operation on the engine crank case is that of boring the crank-shaft and cam-shaft bearings so that they will come the exact distance apart and in perfect alinement with each other and the top of the case when the engine cylinders set. This is done on the horizontal drilling machine shown in Fig. 5. This particular case has three bearings, one at each end and one in the center of the case. Before it is assembled in the jig, hardened steel caps

that have been bored exactly to size, are bolted over the crank-shaft bearings, one-half of which only is in the upper half of the case. The boring bars are connected to the machine with loose couplings so they may be removed while the crank case is being set up in the jigs. Each boring bar is fitted with three cutters that bore the three bearings of both shafts simultaneously.

By former methods used, it was only possible to machine these bearings on 15 cases in a day of 10 hours but since this apparatus was put into use the regular output is 60 per day and the boring is done more accurately.

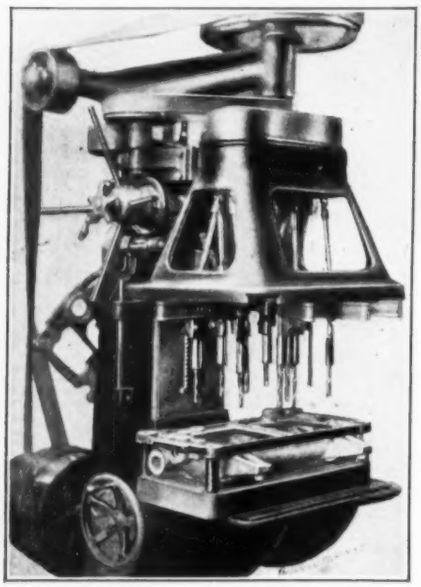


FIG. 3. DRILLING BOLT HOLES

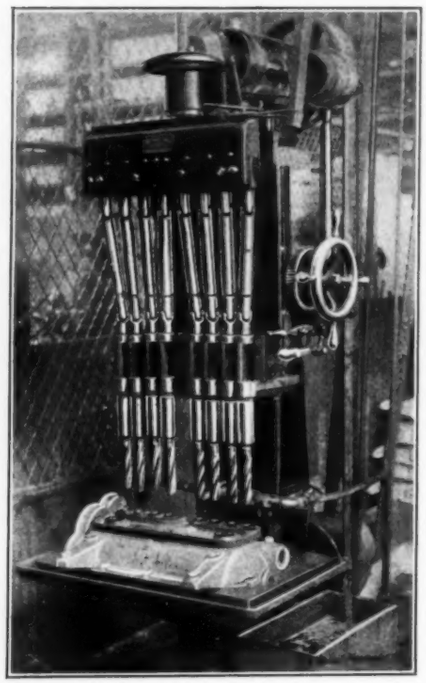


FIG. 4. DRILLING VALVE-ROD HOLES

SETTING BORING BARS

When the case has been set up in the jig and the boring bars have been placed and coupled, split-steel bushings, that are hardened and are a perfect fit over the boring bars and into the bar bearings in the jigs, are slid into place at both ends of the bars, as shown at *A A*. A third boring-bar bearing is located in the center of the jig at *B* and the split bushing *C* is inserted in this. When these bushings are located boring operations are started and a variation of but 1/1000 of an inch is all that is allowed in the finished casting, either in the diameters of the crank or cam-shaft bearings, in the distance between their centers, in the alinement of the two shafts, or in their distance from and alinement with the top of the case.

The three bearings for each shaft have to be a different size in order to get the boring bars out. When the boring is finished the plug gages shown at *B B B* are

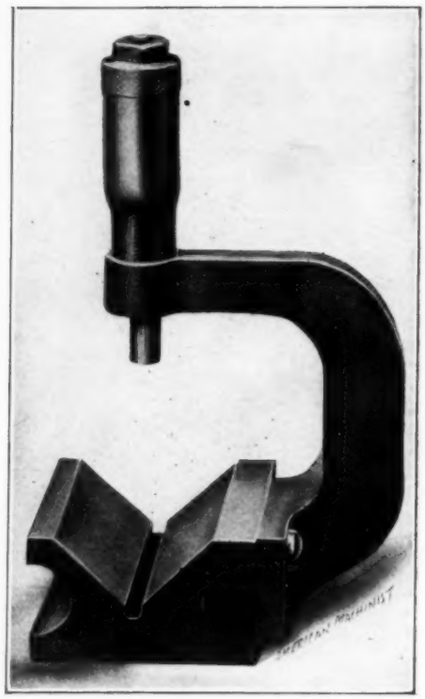


FIG. 6. SPECIAL MICROMETER FOR LOCATING CUTTERS ON BORING BAR

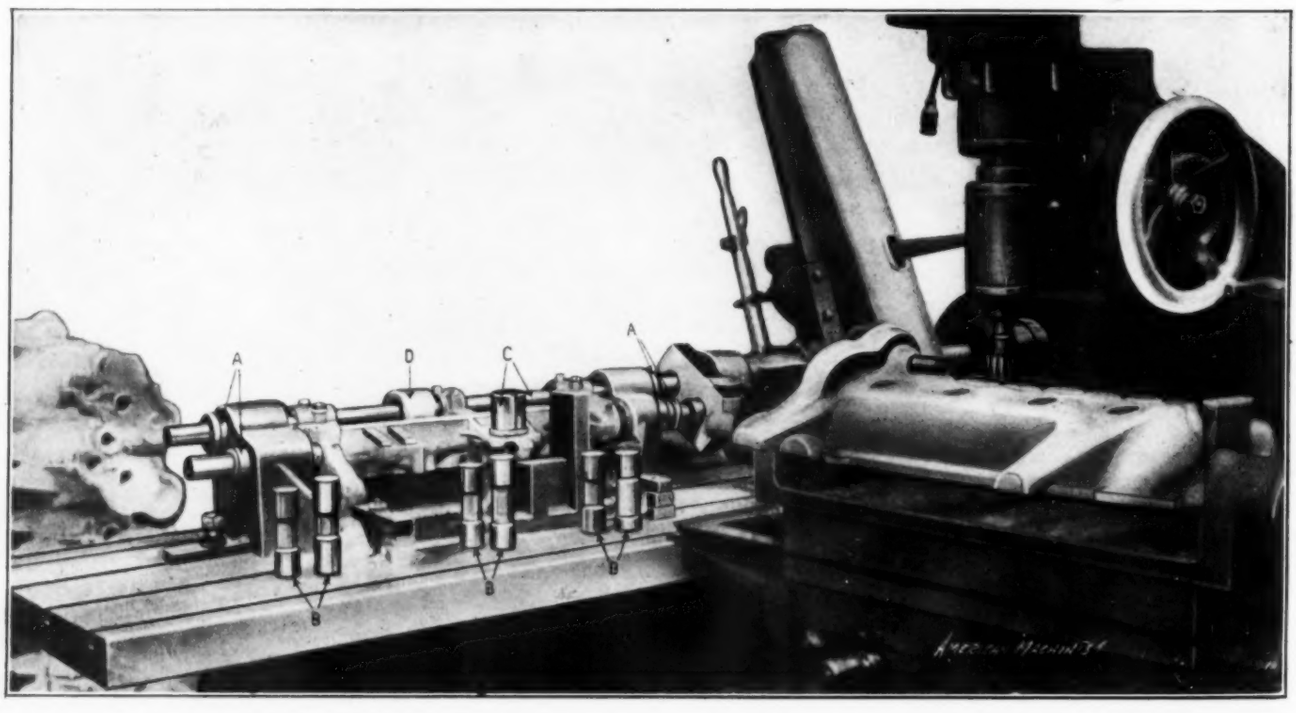


FIG. 5. BORING CRANK- AND CAM-SHAFT BEARINGS, AND REAMING VALVE-ROD HOLES

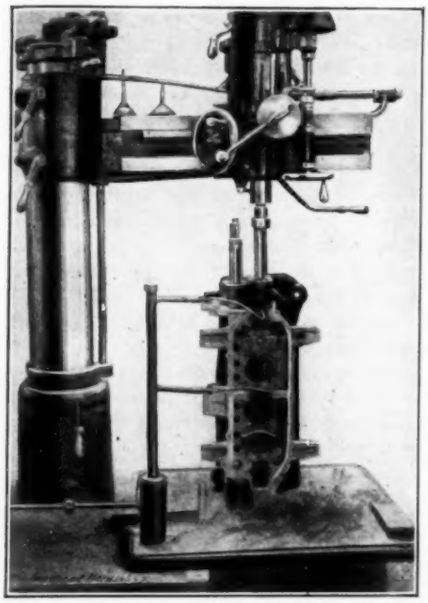


FIG. 7. REAMING BABBITTED BEARINGS

used to see that the holes are correct in size. One end of each gage is a half-thousandth over size and the other end a half-thousandth under size and each hole must be bored so that one end will enter into it and the other end will not. For setting the cutters in the boring bars the special micrometer shown in Fig. 6 was made; the boring bar being placed into the V-block and the micrometer screw end brought down on the cutter.

REAMING SHAFT BEARINGS

After the bearings are bored they are babbitted and taken to the machine in Fig. 7 where the babbitt bearings are reamed, as shown. A hardened-steel cap is bolted over each crank-shaft bearing, as in the boring operation, and the reamer cuts merely the half bearing that is in this half of the case, but the whole diameter of the cam-shaft bearing is reamed. A novel feature of this machine is the stand for oiling that is seen located on a corner of the drill table. A tank is located above the radial drill and the oil is fed by gravity through this stand to the bearings while reaming as shown at *E*.

LOWER HALF OF CRANK CASE

On the lower half of the crank case very little work is performed and this is not of a very accurate nature, as its only mission is to hold the oil, and keep the dirt away from the operating mechanism of the engine. The milling of the surface of this lower half of the crank case, where it is bolted to the upper half is shown in Fig. 8 and aside from this operation there are only a few holes to be drilled or tapped.

There are numerous other operations on the crank case such as finishing the ends of the feet where they have a bearing on the frame, counter boring the bolt heads, fitting the cap on the end that covers up the gears for the cam shaft, surfacing the magneto bracket, tapping numerous holes for bolts and studs, etc., but the jigs and fixtures for these operations and the operations themselves are ordinary machine operations with no great accuracy attached to them and therefore they have been left out of this article.

FIG. 8. MACHINING LOWER HALF OF CRANK CASE

Wear of Jigs and Group Driving

By John R. Godfrey

Shop philosophy dealing with two important questions.

A new superintendent doesn't necessarily have to make changes to make good.

The story is told of a rural stockholder of a railroad who objected to the large item of expense for repairs to locomotives. He contended that "they were made of iron and everybody knows that iron can't wear out."

A similar idea prevails in too many shops regarding jigs, fixtures and gages of all kinds.

In too many cases there is a secure feeling that all pieces are bound to be interchangeable after the proper fixtures have been provided. The wear that begins as soon as a tool is put into use is not always fully appreciated and it often leads to variations in product which seem unaccountable to those who have never experienced this difficulty.

Where the number of pieces is comparatively small, the wear will not be noticeable for a long time, but it comes just the same and must be watched to prevent its getting us into trouble. For there is nothing more discouraging than to rest in fancied security because of special, well made jigs, only to find that confidence misplaced and that the pieces do not assemble as they should.

THE POWER QUESTION

The question of getting power to machine tools is always an interesting one, with many things to be considered, such as first cost of installation, output of the tools, maintenance and cost of power. The individual motor has some advantages, among them being that the machine can be set at any desired angle regardless of line shaft or anything else.

But I ran across a case a while ago that had a peculiar side to it. The owner is an electrical engineer and a good one. Used to build and sell motors for individual drives or any other purpose except pushing a baby carriage. Knew all the arguments that would convince and get orders—and used 'em.

When he went into another line of manufacturing and built his own factory, what did he do?

Individual motors?

A few—two I think for special cases. And the rest of the shop is group driven and not in very small groups either.

Now the question comes—was he a good salesman to sell men what he wouldn't use himself? I don't think so.

Counting immediate dollars and commissions, he probably was a daisy—but I doubt if it's good business to advise a man to do what you wouldn't do yourself in similar circumstances.

The old saying that "a salesman is one who can sell a man what he doesn't want" is all wrong. You may have to show him that he does want or need it, but if you succeed in convincing him of something that isn't so, you'll hear from it sooner or later and it may not be pleasant.

I know of one case where a man re-

fused to sell a certain machine because he was sure it was not what the customer wanted. After frequent arguments, however, he took the order with a warning that it wouldn't make good.

But it did—and the salesman learned more of its capabilities than he knew before. But he still had a friend in the customer and such cases are more than unusual. It's the only one I ever heard of.

Going Off Half Cocked

There is one redeeming advantage in going off half cocked. It's the only way a lot of us ever go off. If we waited till we were dead sure we had sized up the whole situation we very often wouldn't have ammunition enough to wad a gun and the world would lose our words of wisdom. Also the fun of laughing at our mistakes.

A friend of mine runs a shop and hired a young man to help him get things a little more up to date—he knew there was room for it.

The first day the newcomer was on the job he was loaded to the muzzle with suggestions. In fact there wasn't much of anything right about the shop except himself. The boss told him to look around for a month and then make any changes he thought best.

Two months went by and he had made mighty few changes, so the boss asked him why he was going on in the old way.

"Mr. Blank—if you were'nt the best natured boss in the country, you'd have fired me the first day I struck the shop. I was a jackass with a big J and I know it now just as well as you do. A lot of these things looked dead wrong to me because I'd seen them done some other way. But I soon saw that you had a mighty good reason for working your way and I'd have been foolish to change it. I've learned a lot myself instead of showing you as much as I thought I could."

He had the making of a good man and has done good work ever since. A small-bored man would have made changes anyhow just to show that he could, and both parties were benefited by the wisdom displayed.

Special Tools for Gear Case Work

Editorial Correspondence

Drilling and milling fixtures which locate and hold transmission cases for milling and drilling operations.

The tools shown by the accompanying engravings are used by the Warner Gear Company, Muncie, Ind., in machining automobile parts.

The fixture in Fig. 1 holds the transmission case, which is shown by dotted lines, while surfaces *A* and *B* are milled. As will be seen, the case is located at one end by the hub or boss, which is centered in the conical seat *C*, while the the opposite end is carried upon locating pins with jack screws under the points indicated, and obliquely placed set screw pressing the work downward and toward the seat *C*.

The base of the fixture has two bearing surfaces, *D* and *E*, at the proper angle to each other, so that after cuts have been taken over the surfaces *A A* the fixture may be clamped upon surface *E* for the milling of the sloping face *B*. The locating tongue under the fixture is continuous and the latter is, therefore, readily rocked from one face to the other. Provision is made for holding down bolts at either ends of the fixtures and the securing of the fixture is further facilitated by the clamp at *F*, which seats upon a semicircular surface, permitting the fixture to be easily set to either position and properly held to the table of the machine.

Combination Drill and Reamer

The tool in Fig. 2 has at the outer end an end-cutting tool, followed by a reamer of sufficient length to finish the holes at

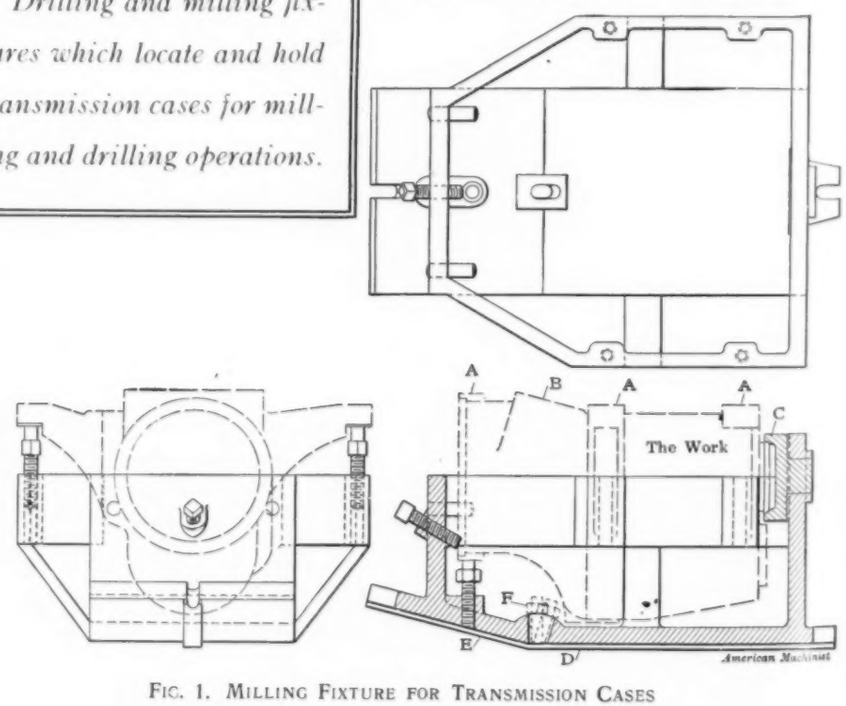


Fig. 1. Milling Fixture for Transmission Cases

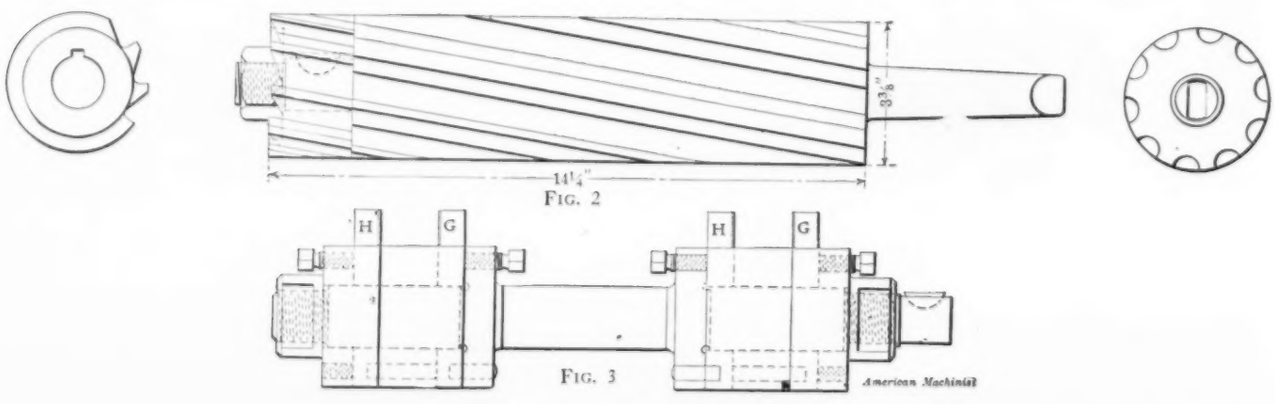


Fig. 2

Fig. 3

"Drill-reamer" and Facing Bar

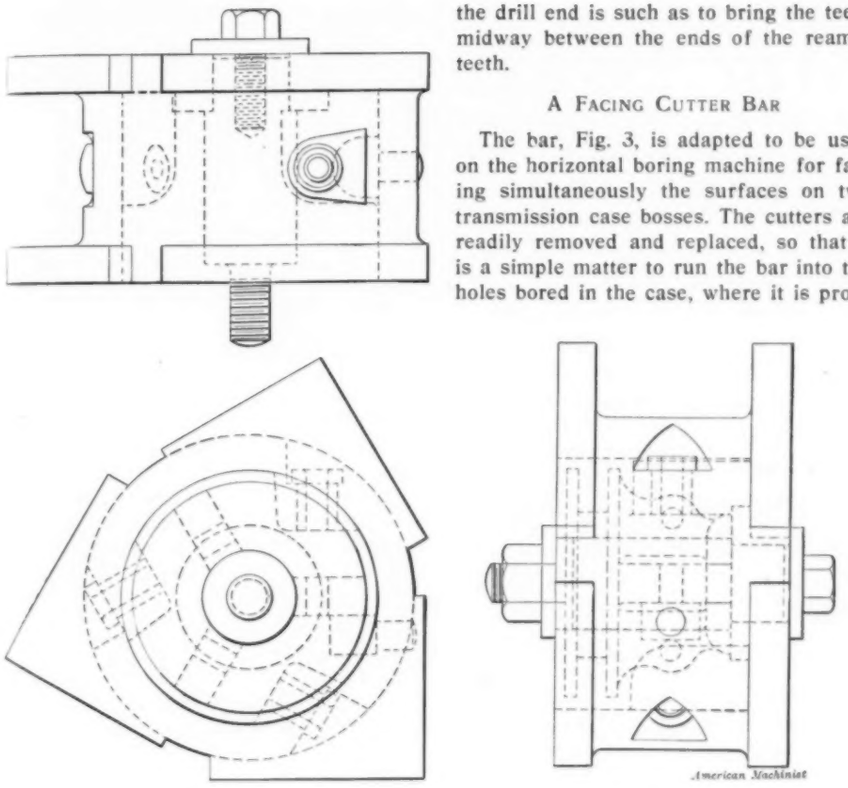


FIG. 4. JIG FOR DRILLING DIFFERENTIAL GEAR SPIDERS

both ends of the case. Both the drill and reamer portion of this tool are cut on a spiral, as illustrated, and the position of the keyway and locating key for the drill end is such as to bring the teeth midway between the ends of the reamer teeth.

A FACING CUTTER BAR

The bar, Fig. 3, is adapted to be used on the horizontal boring machine for facing simultaneously the surfaces on two transmission case bosses. The cutters are readily removed and replaced, so that it is a simple matter to run the bar into the holes bored in the case, where it is properly guided during the facing operation. Cutters *G G*, of course, face the corresponding bosses simultaneously and cutters *H H* are then used on the opposite bosses. The method of building up the bar with collars upon the outer end, which collars are arranged to receive the cutters and the clamping screws, is well brought out by the sketch.

A DRILL JIG

A drill jig is illustrated in Fig. 4 for drilling spiders for differential gears. Three holes are drilled with this jig at angles to one another and the jig is made with three locating faces or bases upon which it rests firmly during the operation under the drill press. As indicated, the work is located properly on a stud passing through the center of the jig.

A serious accident, resulting in the death of a boy, occurred recently in New York. The boy was engaged in making himself generally useful around a small factory. A cheap galvanized-iron bucket developed a hole and the boss told the boy to solder it. The boy evidently had a vague idea that soldering was spreading melted lead over the hole. There happened to be a ladle and lead in the equipment so he melted the lead. Before he died he explained that the melted lead "looked too *thick* so I just poured in some water to thin it." The poor boy was terribly burned by the melted lead and died several days later. It's an old warning never to put water on hot metal of any kind, but it can't be given too often.

A Flywheel Balancing Rig

The accompanying halftone shows a flywheel balancing rig, or device, used by the L. H. Goodnow Foundry Company, Fitchburg, Mass. It consists of two large, turned cast-iron cones, slightly truncated, through which passes an eye bolt having a pivot point projecting downward within the eye, and a large link threaded through the eye, having a bearing for this pivot point.

In use the turned flywheel is supported in a horizontal position, held by the two cones entering the bore from either side. Because of the point of suspension at the top, the flywheel is free and can take any position, depending upon whether it is in balance or out of balance. If it is out of balance, that fact is easily determined by a spirit level on the edge of the rim. Weights are then applied to bring it into a truly horizontal position. After this has been done the weights are weighed and a line is scratched on the inside of the rim indicating the point where weight should be applied and its amount. Thus, of two flywheels that were recently seen at the Goodnow plant, one required a weight of eight pounds to bring it into balance, and the other 43 pounds.

It is beyond the bounds of this brief description to enter into a discussion of the relative merits of this method of balancing, compared with the usual method of mounting the flywheel on a shaft. A little consideration, however, will show that the balance obtained by this method more nearly approaches the conditions required by running balance than the usual static methods.

FLYWHEEL BALANCING RIG

An extract from the recent patent treaty with Germany reads:

"The provisions of the laws applicable, now existing or hereafter to be enacted by either of the contracting parties, under which the non-working of the patent, working pattern (Gebrauchsmuster), design or model carries the invalidation or some other restriction of the right, shall only be applied to the patents, working patterns (Gebrauchsmuster), designs or models enjoyed by the citizens of the other contracting party within the limits of the restrictions imposed by the said party upon its own citizens. The working of a patent, working pattern (Gebrauchsmuster), design or model in the territory of one of the contracting parties shall be considered as equivalent to its working in the territory of the other party."

Letters from Practical Men

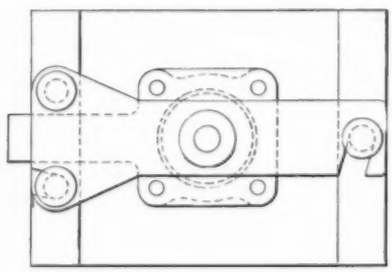
Concerning the details of making things in machine shops, from the first sketch to the shipping room.

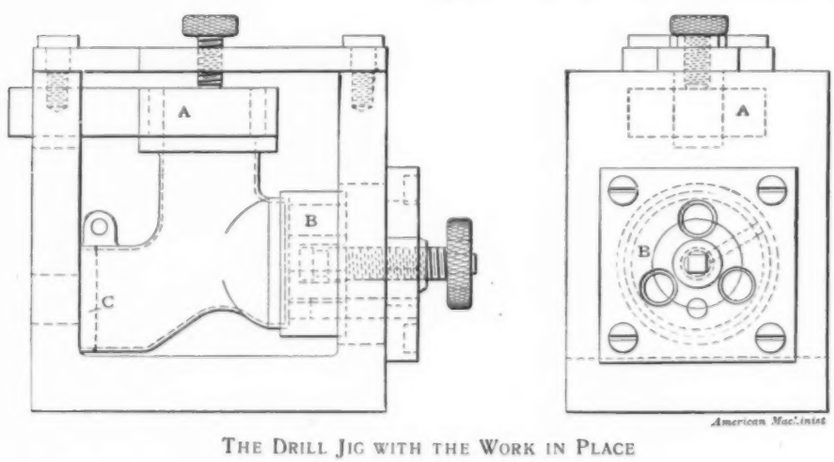
A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

An Adjustable Drill Jig

The jig illustrated in the sketch was designed to drill a job which did not lend itself to accurate turning, which was the operation preceding drilling in this case. The job was a copper casting, a pipe elbow. The machining of the elbow consisted in disk-grinding the flange, boring one end which is shown in position on the locating piece in the jig and turning to a correct diameter the part shown in the sketch with the jig plate *B* in position.

As the bore and the turned diameter could not be guaranteed in alinement with each other, or the bore with the face of the flange as regards hight, something adjustable had to be made in the way of a drilling jig. The holes in the flange had to be located correctly one way with the bore. As will be seen the work is rather a frail piece and a good many were scrapped when holding in the vise while drilling, also a good deal of tube bending, etc., had to be done when erecting owing to the holes being out of line with the bore.





THE DRILL JIG WITH THE WORK IN PLACE

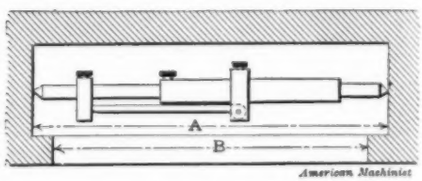
The jig consisted of a cast-iron body, two mild steel jig plates case-hardened, a locating piece, two clamp plates and a few screws. The body was bored to receive a locating piece *C* fitting the bore of the elbow, and slotted to receive the jig plate *A*, this slot being in alinement with the locating piece *C*. The jig plate had four holes drilled at correct centers and perfectly central with the arm which fitted the slot in the jig body. As this slot was in line with the piece by which the bore was located it will be seen that the holes were drilled in correct relation to the bore. The jig body was also cored out to clear jig plate *B* which was adjusted in and out by means of a screw. This screw was held in a plate fastened to the jig by four cap-screws.

The adjustment of the jig plate necessary to overcome errors in turning was obtained by making the end of the screw smaller than the hole in the jig plate. A groove was turned in the end of the screw into which the end of a small headless screw was inserted through the jig plate to prevent the latter coming off when running back from the work. Three holes were bored in the jig plate, three clearance holes in the clamp plate and a pin for keeping the jig plate roughly in line with the clearance holes was provided. A square end was filed on the screw to which was fitted a nurled piece which could be removed when drilling commenced. A swinging clamp was fitted to fasten jig plate *A* when in position for drilling. The jig produced very good work, no scrap being made owing to clamping. It was much quicker than the old way, as very little time was required to insert and remove the work.

Coventry, England. T. B. COREY.

A Telescopic Gage

A few days ago, while admiring the stock of second-hand tools of a local marine-store dealer, I saw a telescope gage as shown by the sketch, which also shows what I believe the inventor of it intended it for: The taking of dimensions *A*, swinging back the link, then closing the gage and removing it and (to use the probable words of the inventor) with the absolute certainty of resetting again to the "fraction of a hair." The gage could also be used in getting dimensions similar to *B*, the link being used as a test piece to retain the original setting.



A TELESCOPE GAGE

Belfast, Ireland. T. E. RAY.

A Drawing Room Kink

In machine or tool design a draftsman often wishes to transfer a small portion of the design to some other part, to ascertain the amount of motion or to otherwise compare relations of several parts. For instance he may wish to learn whether or not he has provided sufficient length of slot in a strap or clamp, to allow of its being drawn back to clear the work, thus enabling the finished piece to be drawn from the jig or fixture.

In such cases the draftsman usually resorts to the use of a piece of tracing paper or cloth, on which he traces by hand the portion of design he wishes to compare. This, however, is not very satisfactory owing to the softness of the material. A small, thin piece of celluloid, say about 3x5 inches roughened on one side by sand rubber makes an admirable substitute, which retains its shape without any trouble and after using the design thereon may be removed with an ordinary eraser or again used at any time.

Providence, R. I. C. W. INGRAM.

A Successful Drawing Room and Pattern System

I here describe a practical drawing-room system which I have used with remarkable success and will submit it to you hoping that it will be of use to some of your readers.

Personally I prefer to have all assembly drawings on large sheets while detail drawings and partially assembled views are placed on small sheets about eighteen by thirty inches. All drawings should have a two-inch margin on the left-hand edge for binding. The complete set of drawings for each machine should be bound by a clamp binder, which will permit of the easy removal of any of the sheets. The drawings are arranged in the following order: First, detail sheets, next forging sheets, then pattern sheets and last, the assembly drawings.

Each type of machine is designated by a letter. Thus *A* stands for lathe, *B* for milling machine, *C* for screw machine, etc. Machine designs as they are made, are given consecutive numbers regardless of type. Thus the tenth machine designed, if it be a lathe, will have a design marked *A* 10, if it is a milling machine a design marked *B* 10, etc.

No attempt should be made to number assembly drawings until all the drawings for this machine are complete. As each detailed sheet is finished it is given a number. Thus the first detailed sheet for machine design *C* 78 is numbered *C* 78-1; the second, *C* 78-2, etc. After the set of drawings is completed, the forging sheets are numbered consecutively with the detail sheets. Thus, if the last detail sheet is numbered *C* 78-26, the first forging sheet would be *C* 78-27. In the same way the numbers of the pattern sheets follow those of the forging sheets, and in like manner the numbers of the assembly drawings are added.

Returning to the arrangement and numbering of the details; the details on the same sheet should be, as far as possible, of parts that fit together in the machine. For instance, having started with the cam shaft as the first detail on a sheet, one should finish with the cams in the order in which they would be put onto the shaft. If this sheet were *C* 78-12, then the part number of the cam shaft would be 1201 and the part number of the first cam to go on the shaft would be 1202, etc. You will observe from the above that the details on each sheet are numbered 01, 02, 03; that there might be 99 details on a sheet without confusion, and that the sheet number and the detail number make the part number. Besides its part number, each detail should have the following information; name of part, number of pieces required, kind of material and finish.

Do not give forging and pattern drawings new part numbers, but transfer the part numbers directly from the detail sheets. On the assembly drawings each piece should be marked with its part number.

When the machines are built, the complete numbers (consisting of type, machine and part numbers) are heavily stamped on all the forgings and finished pieces, where they will receive the least wear. These numbers should also be placed in raised figures on all patterns, so that they will appear on the finished castings. The patterns require no other numbering.

When a change has been made in a part, as is often the case, the detail drawings should not be changed, as this causes confusion, but a new drawing should be made. We "ring out" the old detail by drawing a heavy line around it and, when possible, place on the same sheet the new detail with its new number and the date of the change. If there is no room on this sheet for the new detail we "ring out" the old drawing as above and write in the words "superseded by part number —, date —-— —- —-."

It is evident that this numbering and arrangement of drawings is a practical method of filing them and makes the work of indexing both drawings and patterns a very simple matter. It saves much time and unnecessary handling of the drawings, as all the drawings for a machine are together and the part numbers on any piece show on which sheet to find the drawing. In the assembling room the machines are easily and quickly put together by comparing the numbers on the parts with those on the assembly drawings.

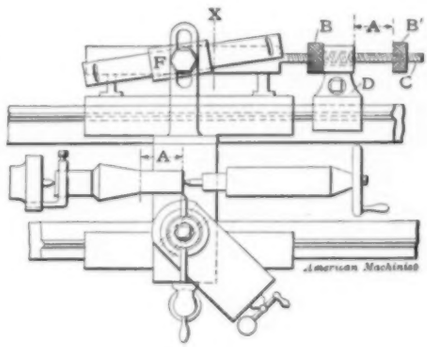
When a customer writes in for a repair part saying that the broken part bears the number *C* 78-1514, this number is interpreted in the drafting room as follows; *C* shows that it is a screw machine, 78 gives the design number, and the records for this machine are easily found. The number 1514 tells two things; 15 shows the number of the detail sheet and 14 the number of the detail on this sheet. The blueprint boy takes out sheet 15 from the design *C* 78 and makes a blueprint of the part 14. This is found to be a casting. If this is an old style machine and there are no repair parts on hand, word is sent to the pattern storage for pattern *C* 78-1514. They are told that it is a bracket for the locking lever and is a small metal pattern on shelf 7. This latter information they obtain from their pattern cards under design *C* 78. If this pattern were at the foundry, this card would show the date and the order number under which it was sent. In the pattern storage, *C* shows the clerk that this is a screw-machine pattern and he goes at once to that division. 78 tells him that it is in section 78, and then knowing it to be a small metal pattern and a bracket, he finds it on shelf 7. These shelves are really only small divisions on a pattern-storage rack. The racks here used have only three shelves, the larger and heavier parts being on the floor, and smaller ones higher up. Thus the correct drawing and pattern are readily found and the customer receives the repair part with little delay.

The details of all successful systems must be carefully worked out and the complete success of this system depends largely upon the coöperation of the shop with the drawing room.

Greenfield, Mass. H. V. T.

Cutting a Straight End Taper Tap

It is sometimes amusing to see the simple manner in which some apparently hard problems are solved. One day the foreman received a drawing of a tap which was straight for two and a half inches and then tapered for about the same distance. The taper was probably at least two inches to the foot. Turning of the tap blanks was a simple matter but to cut the threads was quite a different proposition. Every man was busy trying to solve the problem, but it remained for a "cub" to accomplish this and he did it without any effort on his part.



CUTTING A TAP

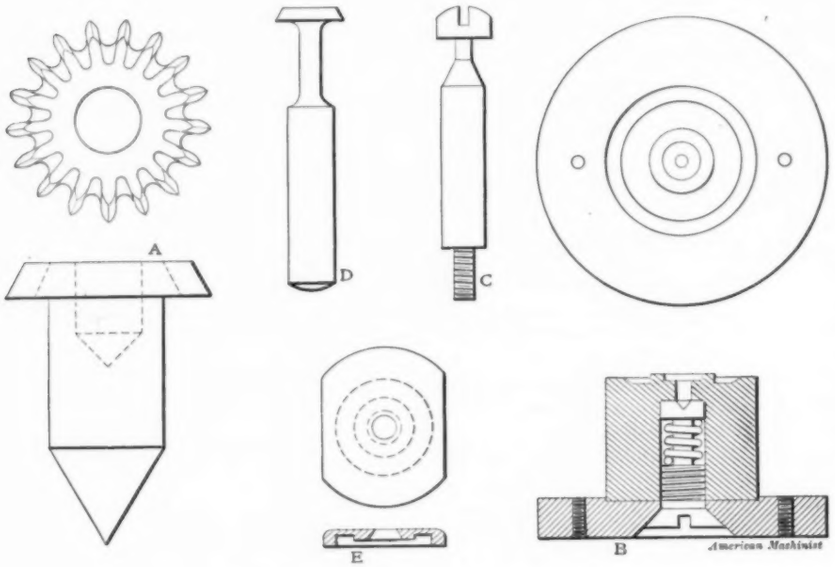
The youngster was roughing out a number of small taper taps on a lathe and when the man who did the finishing came to finish them, he found that they were straight for a short distance on the end. It was soon discovered that the boy had not adjusted the nuts *B B'* properly and the play here was about equal to the length of the straight portion on the end of the tap. It then occurred to the foreman to try to cut the taps in a similar way. By adjusting the clamp *D* to the proper position and then backing up the nut *B'* a distance equal to the straight part of the tap blank it was found to work quite satisfactorily.

By looking at the sketch it will readily be noted that as long as the screw *C* is free to pass through the clamp *D*, the work will be turned straight but as soon as nut *B'* strikes clamp *D* the cross slide will then take the course that the taper attachment is set to.

Westfield, N. Y. GEORGE KRAMER.

Gage for an Accurate Watch Part

In the sketch *A* shows the piece to be measured, a small bevel gear used in the setting mechanism of a watch. The stem is used only while the piece is in process of manufacture and is broken off (after being nicked while soft), after the piece is hardened and the teeth are polished.



GAGE FOR AN ACCURATE WATCH PART

The finished dimensions are, diameter 0.317 centimeter (0.1248 inch) and thickness 0.050 centimeter (0.0197 inch). The thickness is brought to finish from the lower or large side by grinding after the stem is broken off. The diameter of the gear is very important and has to be held to 0.003 centimeter (0.001 inch).

The gage consists of a cast-iron block as shown at *B*, recessed to hold the steel upright, which is held firmly in place by a screw in the bottom. The steel block is bored out to hold a spring and the steel pad in which there is a 30-degree center left to support the piece to be measured.

Two posts, as shown at *C*, are placed in holes each side of the center block and should be made quite accurately.

At *D* is a standard used to produce the top plate of the gage shown at *E*. The conical hole in *E* is ground so that the small end of the standard will be flush with the top of the plate.

To measure the wheel or gear *A* drop it into the center of the gear *B*, place the plate *E* on top and give it a quarter turn which locks it under the shoulders of posts *C*. I then use an upright dial gage to find the error. With a perfect piece the gage should read zero on top of the plate and on the end of the gear.

The angle of the bevel gear is 15 degrees and as an error of 0.001 centimeter in diameter will read nearly 0.005 on the gage, I am enabled to keep a very accurate measurement on the work.

ARTHUR E. GRINNELL.

Waltham, Mass.

Machining Thin Disks

The tools shown in the sketches were devised after some little experiment, for facilitating the tooling of cast and mild steel circular blanks of from 3 to 6½ inches in diameter, and ¼ to ⅜ inch thick. The blanks had no hold and were required to be flat and parallel in thickness and accurate to diameter.

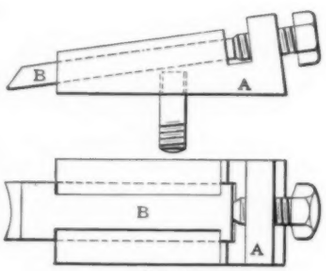


FIG. 1

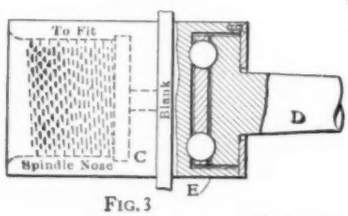


FIG. 3

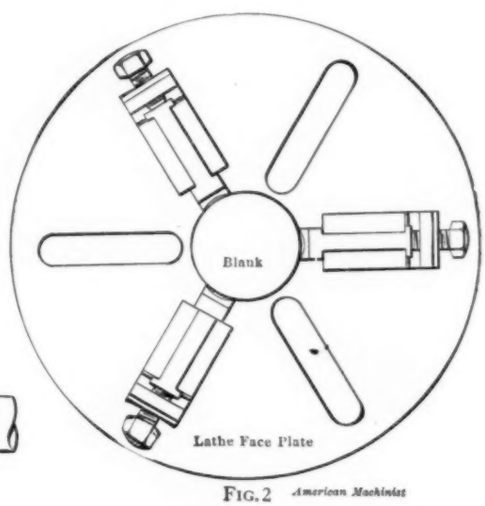


FIG. 2

MACHINING A THIN BLANK

The tools for holding the blank for the first operation of facing are shown in detail in Fig. 1, and in Fig. 2 a set of three are shown in position on the lathe faceplate gripping a blank. These are simply adaptations of the well known toe-dog principle. The tempered-steel jaws *B* are carried in the inclined slots in cast-iron bodies *A*, and backed up and adjusted by the cap screws, the whole being secured to the faceplate by stud and nut.

The business ends of jaws *B* are beveled as shown and hollowed sufficiently to clear the radius of the smallest blanks, and form points to nip into and drive the work. When taking finishing cuts, the backing screws are set up very lightly to avoid springing and the work is gone over twice to take out the forging strains, the tool for the finishing cut being set to a size block from the faceplate. Obviously, when turning over or changing blanks it is only necessary to release one jaw.

As shown in Fig. 3, the holding tools for the second operation (that of turning the diameter) depend largely for efficiency on the well known gripping qualities of paper. The faced blank is gripped between the finished faces of cast-iron cap *C* which screws on the spindle nose, and sleeve *E*, the last forming part of a ball-thrust back-center. A clean sheet of paper is interposed between the driving face of *C* and the blank, which, when the back center is screwed up against it with moderate pressure, provides enough friction to drive the work under cut. As the forgings are clean and the amount of finish small, heavy cuts are not necessary.

The construction of the back center needs little explanation. It consists of a case-hardened and ground body *D*, the shank of which fits the center hole, and the sleeve *E* also case-hardened and ground, with a standard ball-thrust washer between them and a plate screwed on at the back to keep the parts together. Cap *C* is made in several sizes to obtain the maximum gripping surface on the various sizes of blanks. This tool is also useful in turning trial blanks for forming dies.

Manchester, Eng. GEO. E. GAY.

Discussion of Previous Question

Press Tools for Forming Tubular Work

At page 79, Frank Greiner describes some tools for the production of a tubular piece of work called a funnel. As in closing, he throws out the suggestion that with proper machinery his method could be improved on, I would like to show a method that he might adopt, with no other means than those already at his disposal.

The first operation would still remain the same, raising the blanks into a U shape; after that the tubes may be finished in one operation instead of three as shown. Fig. 1 shows the tools closed with a tube in position. The various parts are: *A*, the punchholder; *B*, the punch, which is provided with a series of spring pins as shown in the section; *C*, the bolster, which is machined to take the various members which form the die; *D* the die parts of tool steel which are machined to shape and drilled and tapped on their under side for the screws *E* which serve to retain the die parts in place, and also to transmit the pressure of the springs. The screws and springs are disposed as shown in the partial plan, Fig. 3. The other parts *F* and *G* together form a cam which has a limited movement around the axis of *G*. The latter is of mild steel and *F* is of tool steel dovetailed to *G* as shown.

The action of the tools may now be described. The U-shaped blank, together with a mandrel of the proper form, is placed in the die when in the position shown in Fig. 2. The punch now descends, the spring pins press on the work and mandrel, and continuing, the corner

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

H of the punch proper bends the upper free part of the blank over the mandrel. This part of the operation is done while the die remains in the position shown in Fig. 2; that is, the springs must be strong enough to support the die while this first bend takes place. Further movement of the punch will cause the die to descend and the lower side of the blank coming in contact with corner *I* of member *F*, will be bent upward at right angles to the lower side of the blank. Directly the upturned edge of the lower side of the blank has passed below corner *I*, the corner *J* of the punch will come in contact with *F* and force it over to the left, finishing the bend of the lower side and planishing the tube all over as will be seen in Fig. 1.

Of course, the die will be best made in parts, and also the cam, owing to their length, but the lower circular part *G* of the cam may be of one piece of standard stock. With a punch holder of substantial section as shown and the punch in one piece there would seem to be no reason why a length of work much greater than was shown should not be done at each operation. And now may I make another suggestion? This is a job which might well be done on the draw bench, and perhaps some reader who has had experience in draw-bench work will show us how.

London, England. W. L. FRENCH.

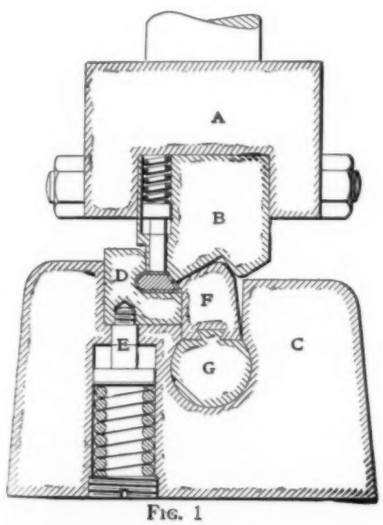


FIG. 1

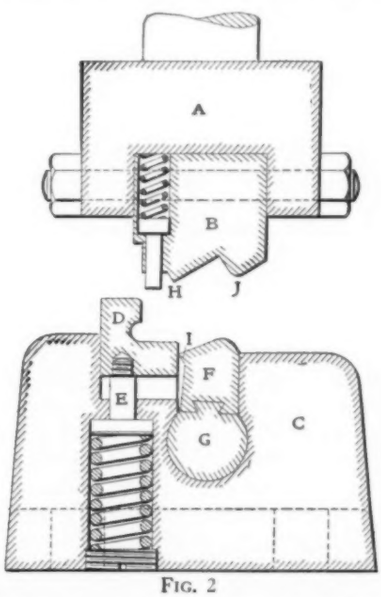


FIG. 2

PRESS TOOLS FOR FORMING TUBULAR WORK

The Expert Operator

I was interested by a short article which recently appeared in the columns of the AMERICAN MACHINIST under the above heading. Having been an expert operator of machine tools for some years I have been hard pressed occasionally to come up to "estimated" and "guaranteed" production when operating new machines on test. There is a great difference between "estimated" output, and "guaranteed" output. When the latter conditions are insisted upon it must be adhered to. I have known of a few instances where the guaranteed times have not been figured correctly and consequently the tools have had to be taken out at considerable cost to the firm who supplied them. The expert operator is often strange to the work involved, whereas the workman who has been employed on the same job by former methods will have become thoroughly acquainted with every operation thereon. It will therefore be seen that the "expert" must be no novice. I have often noticed that when an expert goes into a shop he is set to do the most difficult, and sometimes even useless pieces of work, or operations, just to see if they can be done. I well remember once going to demonstrate a well known patent automatic reversible machine tapper; its capacity was only ⅜ inch; when I arrived the only drilling machine at liberty was a heavy radial. Fitting the small tapper, with a No. 1 Morse shank with a set of reducing sockets in this large machine,

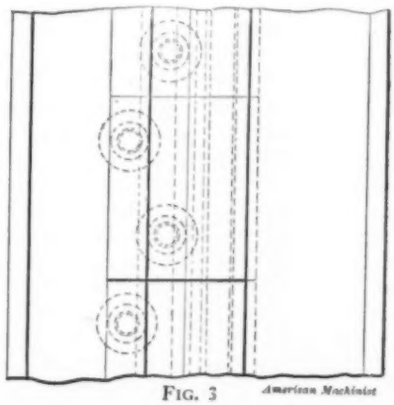


FIG. 3

was like driving tacks with a steam hammer. The sockets had all been knocked about very much, and had the driving portion for the drill tang practically worn away. The test imposed was to tap several holes ⅜ inch Whitworth, 2½ deep in a machinery-steel block. I pointed out that this was not a fair test, and never likely to be actually wanted in the ordinary course of events; the manager, however, insisted upon it. What with a heavy cumbersome machine, and bad fitting sockets and the driving flats worn off I could not get the tap to go far down before the sockets started to ride over the flat on the tapper shank end, with the result that after half an hour's experimenting I had worn the tang nearly off the tapper shank, so I retired, beaten through not having a fair trial.

I could cite many similar cases. However, in spite of them the expert operator has undoubtedly done a lot toward introducing modern machine tools into some of the more conservative firms in Europe.

EXPERT OPERATOR.

Acton, London, England.

Patterns for Plate Pulleys

Referring to my article on the above, which appeared on page 706, Volume 32, Part 2, and claimed the method described was cheaper and better than a pattern built up of wooden segments, I note with interest that Mr. Patson, on page 461, Volume 33, takes exception to my remarks and describes three methods of making small wooden patterns which in his opinion are preferable to my method. While admitting they are very good and interesting, would it not be as well to consider the circumstances which our respective positions place us in, which, to my mind, is an important consideration?

I am engaged at a concern which has no foundry of its own, thereby having to send all patterns out to a place which is a considerable distance away. Further, I would state the iron rims are made from scrap pieces of piston pipe which are left over after the required number of rings have been cut off and the wooden center being put in by an apprentice patternmaker. Having a pattern as I have described, I have a permanent pattern which does not require machining all over before a quantity can be cast off it. As regards Mr. Patson, he may have no machines or pieces of scrap pipe at his command to produce the pattern, but from his description of making these patterns, I should imagine he has a foundry and foundry implements at his disposal.

Hence my reason for thinking that both methods are equally good, considering our respective circumstances.

Manchester, Eng. A. HEARN.

A Tool Post Wrench

Referring to the tool-post wrench shown on page 269, Volume 33, Part 2, I wish to say that wrenches, commonly called tuning hammers, made in that form have been used by piano tuners for many years, and, because of but one head being required on such hammers, they are lighter and more compact than the ordinary double-headed tuning hammer.

Dayton, Ohio. F. K. F.

Prevent Breaking of Center Drill

In recent numbers I read an article on removing a center drill after it has been broken. The process is a good one, but cites the old saying "an ounce of prevention is worth a pound of cure." The great trouble with combination center drills, especially small ones, is that the drill part does not cut large enough to clear itself, thus making it bind and very often break and after breaking it is bound so tight that it is impossible to remove except by some expensive way. By a little forethought all this trouble can be overcome by grinding the center-drill one lip a little longer than the other, the drill will cut itself clear, cut faster and if it does happen to break nine times out of ten it will by a little rapping drop out itself.

Providence, R. I. D. W. M.

Fallacy of the Large Shop Order

In the editorial entitled "Fallacy of the Large Shop Order," on page 797, there are some points to which exception might be taken, also features that might be added to strengthen the argument.

For example; would a shop of a given capacity—which ought, to make it profitable, to be kept running as near maximum as possible—require any more raw material on hand, or any more going through, on account of the large order than a series of small ones?

A good purchasing agent can arrange the incoming of raw material to a comparatively even monthly figure regardless of how orders are put through the shop. For the 500-lot referred to, deliveries could be regulated, spreading them over the 18 weeks, making each only a little larger than the one for the 50-lot.

Regarding the time the 500-lot is kept in stock before being sold, no one can deny that this constitutes an additional cost, and an item that should have careful consideration but which is often overlooked.

Taking the minimum time factor per piece, and the difference between the 500- and the 50-lot—2 to 1½—a good many shop managers will at once take exception, until they figure it out for themselves. For this difference, the natural inertia of size is given as one reason; the probabilities of waits for machines as another. The latter is self explanatory—the former vague, inasmuch as there is no reason given.

The natural inertia cannot very well come from the machine itself or the power that drives it, therefore it must be something else, and herein comes one of the features overlooked—the man. Men are not machines and cannot be belted or geared to run at a given speed. Eighteen weeks doing the same thing every day—108 working days—becomes monotonous in the extreme.

A man may run a lathe for a good many years and not lose his interest in that machine or his work, if he has the opportunity of trying out a variety of operations—turning, boring, drilling, cutting threads, small work or a large piece that taxes his ingenuity—yet put that same man on 500 parts all exactly alike, knowing that it means many weeks before they are finished and he loses that interest after the first few days.

As a further analysis of the figures, let the investigator who discovered that 50 was a better number than 500, divide the time up into lots of 50 each on his 500 lot, and see if he does not find that the first 50 approximated the time for a single lot of 50, while the increase was in proportion to the second, third, and fourth lot, etc., and the last 50 nearer three times the time factor than two.

Is it not the human element in the man that causes the inertia and accounts for the difference between the 50 and the 500 order—the 1½ and the 2? Is not the fallacy of the large shop order more in the operator than anywhere else, other conditions being equal and isn't the time saved in setting up, that we hear so much about, absorbed by lack of interest when the same thing over and over again causes it to lag? Ought not the element of interest in his work, by the mechanic, be taken into account, as much if not more than any other feature or condition governing the size of shop orders to be put through.

The men in the shop never take the interest in a shop order that they do in a special order. Immediately an order for something that attracts attention in the mechanical world gets into a shop, watch how interested everyone is, even down to the youngest apprentice boy. It is talked over going to and from the shop and during the noon hour; told to friends in other shops with a considerable amount of pride. Each man likes to get some part of that order to do. Once while attending one of the world's fairs, as I was looking at a large engine, a man standing beside me turned and said, "I chamfered those nuts on that cylinder,"

and there was a strong pride in the tone of his voice.

The mechanic's interest supplies energy which tends to keep things moving—its absence means the inertia which is hard to understand, when the economy of large orders is considered in the abstract and along lines which tradition has made the average man think must be so, on account of the general acceptance.

New York City. SAMUEL L. PLATT.

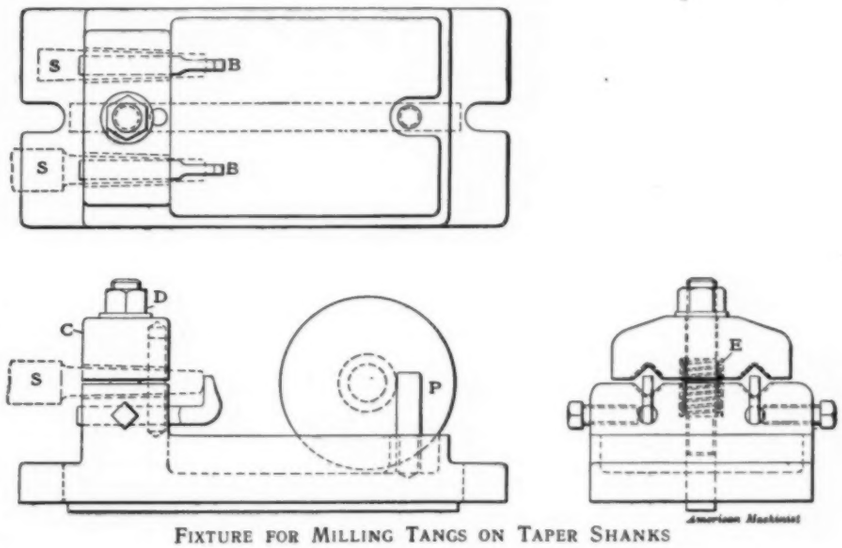
The Water Sealed Varnish Pot

At page 1027, Volume 32, Part 2, is shown a varnish or shellac pot used at Lowell, Mass. About 20 years ago I devised a pot similar to the one shown to hold shellac varnish where the shellac had been cut with alcohol. I used a water seal and felt that the question of evaporation was settled so far as sealing went. Much to my surprise there appeared to be water in the shellac after standing idle a short time, and I began to suspect that there were a few things about evaporation which I hadn't solved. In taking up the subject later in my studies I learned why water did not seal alcohol and why my alcohol shellac had water present. While the whole subject of liquids, vapors, surface tensions and their relations to each other is somewhat abstruse, it may clear things for some of your readers to open it a little. Any liquid has present adjacent to it a certain amount of a vapor of that liquid, that is to say, that in case of my water-sealed shellac pot there was present in the air adjacent to the water a certain amount of water vapor and in the air adjacent to the alcohol a certain amount of alcohol vapor. It will thus be seen that the air in the can contains both water vapor and alcohol vapor. The warmer the air the more vapor it will absorb and contrawise, all it needs is to be cooled to make it give up a portion of the vapor it contains. This is precipitated into both the water seal and into the shellac and in this manner the alcohol may be said to have evaporated into the water and *vice versa* the water into the alcohol. With two liquids, therefore, like water and alcohol in close proximity to one another there is a considerable mixing and the water makes a rather inefficient seal. Mercury, on the other hand, makes a good seal, but is not conveniently handled on account of its other characteristics.

Boston, Mass. "CASE."

A Fixture for Milling Taper Socket Tangs

At page 1143, Volume 32, Part 2, S. R. C. describes a fixture designed for milling taper socket tangs and its construction limits it to sockets of one length. Probably there were enough of these sockets to warrant having a fixture for them only. The vital points of a socket or any taper shank are its size, gaging from the small end, and the dimensions of the tang relative to the small end. A variation in length over all, under ordinary conditions would make no difference. Yet in S. R. C's. fixture a variation in length over all would affect the length of the tang and change its relation to the taper. Assuming that the methods used will produce sockets of exactly the same length, there is likelihood of some being turned small, making it necessary to cut off the small end, changing the length and thereby affecting the length of the tang. The stop *C* of his fixture limits the usefulness of it to short sockets. In my opinion it is not best to use five cutters to slab eight surfaces. Cutters will become dull and will be reduced by grinding. This method permits of no adjustment for size of tang unless the cutters are made in halves. Better have a cutter for each surface to be milled and change them so as to use both sides.



FIXTURE FOR MILLING TANGS ON TAPER SHANKS

The accompanying sketch shows a fixture which will accommodate tools of any length or diameter of body, either with finished shanks or shanks with stock allowed for grinding. Referring to the sketch, the sockets or taper shanks are shown dotted at *S*. They are inserted, small end first, until the ends come in contact with stops *B B*, and are held in place by clamp *C* and nut *D*. The left-hand end of this fixture comprises the essential parts but the oil reservoir and safety stop pin *P* add greatly to its usefulness. The cutters run in oil; the oil is prevented from running over the machine, and stop pin *P* prevents the operator from running the fixture into the cutters. Clamp *C* is held up while changing work by spring *E* the same as in the fixture previously illustrated.

Chicago, Ill. G. W. ROBBINS.

Milling Disk Cams

At page 170, C. G. Heily described the milling of disk cams and the necessary setting of the dividing head to accomplish the required results. It may not be amiss to point out a ready method of duplicating these cams. In the relieving lathe there is a cam which advances the tool to give the relief to the cutter or tap which is being made. This is a single lobe cam; it steadily advances the tool to a point and then it quickly withdraws it. This operation may be performed as many times as may be desired for one revolution of the work. It follows therefore, that if this cam be so designed, we may get as many cams as wanted with as many lobes as required, by simply changing the gears. And further, they may be either disk cams or face cams.

London, England. W. L. FRENCH.

In an article appearing in *Cassier's Magazine*, dealing with vanadium steel, it is pointed out that the special steels containing nickel, chromium or tungsten have now been in use for some years and have been well suited to many requirements. But where they have produced increased static strength they have caused a decrease in the dynamic quality of the material. It is by the application of vanadium to such steels that success has been accomplished, and a steel obtained satisfactory both statically and dynamically. Vanadium steels have now been in use for ten years and have been subjected to severe tests. They have well justified all that was predicted of them. The automobile industry, more than any other, has compelled the steel manufacturer to institute improvements in the quality of steel. The requirements of modern automobile construction are most drastic, and steels which prove satisfactory in service in the axles or springs of motor cars can be safely reckoned upon to stand almost anything.

Examples in Modern Grinding Practice

By H. Darbyshire *

Practical suggestions for grinding operators. Various devices used to obtain desirable results in form and high speed steel grinding.

*European demonstrator, Norton Grinding Company.

At page 174 J. H. Hollinger asks me a question regarding estimates on grinding, and immediately afterward he gives what may possibly be the correct answer. Probably A and B did not submit an intelligent estimate, but as the first Norton estimate was 60 minutes and had to be reduced to suit the customer, it was assumed that A and B had been given a similar opportunity and had submitted the best time they could. If I committed any error it lay in my making a comparison, and this explanation, I hope, will be sufficient apology to Mr. Hollinger or any others who may be interested in the matter.

Blunt Diamonds and Strong Grinding Solutions

Mr. Hollinger says he obtains a high finish by using a blunt diamond to true the wheel, or by using an extra strong solution of soda water and oil; briefly speaking, he obtains the same results by a more expensive means than I described and perhaps the only objector to his method would be the individual who had to provide the requisites. His advocacy of the blunt diamond, however, may be taken too literally by some readers and its possible adoption lead to troubles I have met with occasionally; the same may be said of a too strong grinding lubricant or solution which may become so viscid at the grinding point as to allow some heating of the work; this is the more likely to occur in work of tubular form or in long heavy pieces which it is not convenient to stiffen with steady rests. A recent experience with the grinding of some steel pipe rolls will serve to illustrate this.

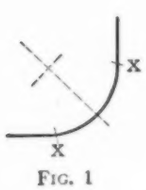


Fig. 1

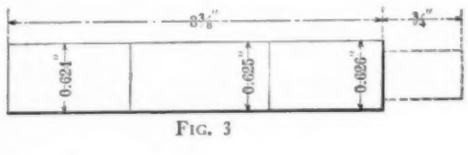


Fig. 3

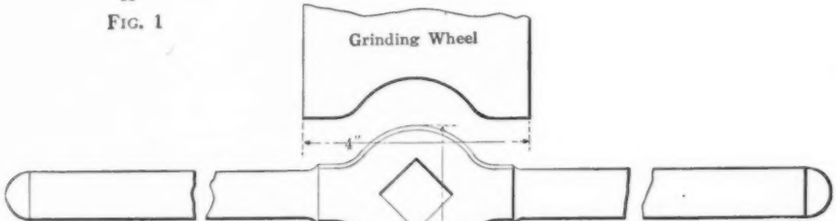


Fig. 2

Examples in Modern Grinding Practice

A Practical Illustration

A machine had been supplied to a customer and successfully demonstrated for the grinding of steel-pipe rolls mounted on axles, the roll portion being 5 feet by 6½ inches, and of 3/16-inch section. Some three months later a complaint was made by post that the machine would no longer grind the axles cylindrical and that they always came out oval in shape. A reply was sent telling them to see that the water connections were all clear and to use a full stream of water while grinding but as the complaint still continued I was sent to investigate the matter. I found all conditions good except that the grinding solution was of a thick, soapy nature and was coming from the delivery pipe in the form of suds, although the operator vowed he had made the right mixture some few days before when filling the water tank. About two-thirds of the solution was taken from the tank and replaced with fresh, clean water and there was no further trouble.

An Operator's Risk

Now, I always make a practice of comparing notes with any grinding operator I meet, and have at times listened to some startling theories, yet as a rule, many valuable points may be obtained thereby. On this particular job a Norton 24K wheel was being used, and although it was quite suitable for the roll portion it was too soft to give a high finish on the axle portion. In a burst of confidence this particular operator told me that he had hit on an original way of obtaining a high finish, and by way of favor, he demonstrated his method for me as follows: In finishing the axle end he turned off the water cock part way and picking up a large oil can, he began to lubricate the wheel at the grinding point with a copious supply of oil, about half a pint per minute. The results were somewhat gratifying and I, of course, complimented him on his ingenuity, but was compelled, in his employer's and my own interest, to point out that the oil ran into the tank and that he would soon have the solution in its previous condition if he continued the practice.

What the Blunt Diamond Does

A few weeks ago a customer complained of wheels supplied him, contending that they were not duplicates of those previously used although labeled the same grit and grade. A visit to the works elicited the fact that the wheels would rough out all right but they could not finish with them as they did with the old ones, and they burnt and discolored the work and caused the fine chatter marks occasionally; the diamond used for truing the wheels was examined and found to be as rounded as a pea and resetting it with a cutting point projecting got over the difficulty.

A blunt diamond is an abomination and to my own knowledge has caused endless and costly trouble both to wheel makers and users. A diamond is a tool provided as a means of truing the wheel to shape or removing glaze and in a blunt condition will only aggravate the latter condition; it can only true the wheel when the spindle is in perfect running order and only attains this end by rolling and burnishing the grit of the wheel into anything but a cutting condition; while in this state it is a polishing wheel only and will engender unnecessary heat in any work on which it may be engaged.

Trouble with a Poorly Faced Wheel

Only a few days ago I was visiting a factory and my attention was drawn to a Brown & Sharpe machine in which the operator was grinding the front journal of a turret-lathe spindle. The superintendent complained that the man had been engaged some 90 minutes in finishing this part and could not get it round within 0.0075 inch, although the grit and grade of the wheel were quite suitable for the work. An examination of the wheel face raised a suspicion of the cause, which was found to lie in the bluntness

of the diamond; the wheel was immediately trued up with a diamond which had a cutting edge and the journal was finished in a few minutes without any difficulty.

There are various ways of setting a diamond so that it can be readily turned when one edge is blunted; some of these have been described in this journal and others will, no doubt, suggest themselves to users. It is essential that it be kept sharp just as with any other cutting tool and this seems to be a point that is overlooked by many. Either of the two conditions (a viscid lubricant or a compressed wheel face) may well cause the twist-drill trouble to which the correspondence referred to at page 275 of this journal.

Importance of Ample Water Supply

This correspondence in some cases agreed with my own experiences and opinion, that is that twist drills can be wet ground successfully and I had never heard of a case of failure before. The failures referred to may well lead one to suspect that they arise from some cause unsuspected, either those already referred to, an insufficient water supply or an improper application of the water supply. I have seen many grinder hands who fail to recognize that the place to deliver the water supply is directly on the grinding point, and that it is not provided so much as a means of quenching heat but rather to prevent it arising. In many cases this is due to not drawing the wheel guard back as the wheel is reduced in diameter and so the water tends to fall on the front of the work rather than on that point at which the wheel is engaged. The firm of Ludwig Loewe & Company have some 20 machines at work grinding twist drills of Novo steel and never have this trouble with drills cracking and I know of many others in England and on the Continent who are free from it.

Wheel Truing Devices

Mr. Hollinger takes some exception to my wheel-truing device for radii. In the first place, the provision of plugs for getting the various radii may be a little more trouble than a system of graduations, but I prefer them as being more foolproof. Further, one plug of ¼ inch diameter is sufficient and little bushings do the rest. He does not see how I get a positive 90-degree movement, and describes a fixture he prefers which is provided with stops to insure this and an eccentric bushing for adjusting the cutting *point* of the diamond quite central. Now, the diamond supplied with the fixture I described is set eccentric in its holder and its cutting edge is set to a line scribed on the setting plug or bushings, which are pinned in a central position. Formerly I fitted my fixture with latch stops to insure a positive 90-degree movement, but abandoned them later because a positive 90-degree movement it is fatal to the radius being turned, owing to the slight wear of the diamond or inequalities of its cutting edge.

The Radius Difficulty

Mr. Hollinger describes a truing fixture which is identical in principle with mine and which I have myself used and in theory they may be correct. He speaks of "the cutting *point* of the diamond" which in geometry is described as something without length, breadth or thickness. Unfortunately a diamond is a perishable article and will not retain this desirable condition long, so it may be better to describe it as a cutting edge. If this cutting edge could be kept quiet parallel with the wheel face the full 90-degree movement might be made with safety but it is not always so and again turning a 5/8-inch radius on a 24-inch wheel corner makes the cutting edge somewhat concave, there is always a little error at points *x x*, Fig. 1, and it seems to be a result of the face, side, and radius truing being three separate operations.

The Humble Pebble

It is here where the much discussed pebble comes in useful for removing the sharp corner left on the wheel and which would be repeated on the work; in addition to this it removes that slightly raw condition which is present on a face of a newly trued wheel and which prevents a high finish being obtained until it has been removed by some few finishing cuts or by other means when there is not enough stock to make this convenient It is, of course, a slight error but it is clearly seen on applying a radius gage. The sense of touch, however, multiplies the error many times and this is what continental car-axle inspectors seem to depend on mostly, for they are inclined to reject axles when the finger shows the slightest depression at these points. In a smaller radius such as that of an automobile crank there is the same error left but the radius is too small for the finger to detect it yet it can be seen and over here the pebble is in almost universal use to remove it, otherwise cranks would be rejected where made by those who manufacture for the trade.

Axle Grinding Practice

Mr. Hey on the same page (174) tells us that he ground a pair of car axles including radii in an average time of 50 minutes each, which may be said to be a creditable performance considering the amount to remove and other circumstances. He might, however, have been more explicit and told us for instance how be formed his various radii on the wheel. It will be noticed that his wheel must have a 5/8 radius on one corner when he has finished his first axle end and that he has to put a 3/8 radius on the next. I am assuming from this that he finished each axle end completely, otherwise it would seem that he must change the wheel for one with a 3/8-inch radius or else turn at least ½ inch from the diameter of the one with the largest radius, otherwise he would have to handle the axles at least twice.

This axle question is of interest for it has been my experience that in this particular line time is everything and there is no margin for any fooling, and the question of radius grinding is of special interest to many people who study grinding matters. In addition I may say that like many other machine parts people over here are beginning to fall in with the idea that finishing car axles with the grinding machine is more economical than finishing with the lathe.

Form Grinding

One important feature of the Norton plain grinder is the massive spindle which allows the carrying of a 4-inch wheel on even the smallest type of machine. This broad wheel face, of course, increases the capacity for removing stock but many jobs of form grinding may be done to advantage and should be of interest to those who use many drop forgings. The same principle would apply to the surface grinder.

Fig. 2 shows a drop-forged tap wrench, the only lathe work done being the rounding of the ends and the centering. The arms are ground outright from the drop forging on a 6x32-inch machine and the shape at the middle formed with a wheel turned to shape. About 0.040 inch is removed from the diameter and the production is from 6 per hour of the larger sizes, to 10 per hour of the smaller. A 24M wheel is used and requires a slight dressing on its parallel face for about every dozen wrenches. The finish is much better than can be obtained in the lathe and production is far greater. Another interesting example in this line is the small shaft shown in Fig. 3. This also illustrates the value of the accurate and reliable automatic and micrometer wheel feed on the machine. These shafts are turned in a turret lathe and a small tenon is left on for driving purposes, the cutting off of this being the last operation.

Shaping the Wheel for Forming

To shape the wheel a good hard and sharp diamond is used, the face being first made straight, the wheel is then fed in to the diamond by means of the dial micrometer feed for the difference in diameter of the middle and smaller end, the same method being employed for forming for the larger diameter, a full stream of water being used and the depth of cut being only 0.00025 inch each pass so as better to preserve the cutting edge of the diamond. A 24M wheel is used, the shaft being of Siemens Martin steel

and 64 per hour have been ground, removing an average of 0.008 inch from the diameter and the wheel will duplicate about 40 within the tolerance allowed.

There are numerous little jobs to which this form-grinding principle will apply and which would find further scope for the arts of drop forging and making of fine castings. To test the wheel shape when turning it a piece of tin or sheet steel may be ground of the form as the turning proceeds and a male templet applied until the form is correct; this is more convenient than stopping the wheel and applying a templet or gage.

Excessive Heat and Its Results

Mr. Scott at page 222 states that he has trouble with the grinding of high-speed and fine-finishing steels and he may, I think, look for the origin in some of the various causes for excessive heat generation which I have mentioned previously. Again it is almost fair to say that grinding will soften the immediate surface of hardened steel no matter what wheel may be used and the alternative is to limit this depth as much as possible.

Many years ago I had similar troubles and do now occasionally witness them but have always found them to be due to one of three reasons, either too fine a wheel, too hard a wheel, or too high a wheel speed. Given that other conditions are right, either of these three will generate unequal heat, which is no doubt the prime cause of the trouble. A wheel too hard we can easily understand as being harmful, as also too high a wheel speed; a wheel too fine, even of a suitable grade, does not allow the water to get at the grinding point as easily as would a coarser one and I would not care to use anything finer than 46 grit for this class of work. To my mind wheel makers catalog wheels which are too hard for edge-tool work and at least it would be better for their customers to pay a trifle more for wheels than to have the costly experiences of Mr. Scott.

I well remember a large batch of hardened thrust collars which were ground on a universal machine with a grade L80 grit, wheel, and immediately after grinding the collars looked and rung all right, but after lying some little time they were found to have developed surface cracks and gave quite a leaden sound when rung on a plate, while a large number of them fell to pieces. The wheel was changed for one of 36 grit grade K and the trouble ceased; plenty of water was used in both cases.

Dressing Grinding Wheels

Some points on truing and dressing of grinding wheels abstracted from "Grits and Grinds" prepared by the Norton Company.

The difference between glazing and loading of a grinding wheel is not always clearly understood.

A loaded wheel is one whose face has particles of the metal being ground adhering to it—one in which the openings or pores of the wheel face have been filled up with metal, leaving no room for clearance. It is not necessary that all of the pores or openings between the cutting particles on the face of a wheel be filled up or loaded to prevent the wheel from cutting. The presence of a number of these pieces of metal on the face of a wheel prevents the wheel from cutting into the work and the loaded places will, of course, create heat.

A Glazed Wheel and Its Effects in Grinding

A glazed wheel is one whose cutting particles have become dull or worn down even with the bond, the bond being so hard that it does not wear away fast enough to allow spaces between the cutting particles, or the cutting particles to escape when dulled. In a glazed wheel, the cutting particles and the bond at the extreme surface of the wheel are of the same radius.

It will be noted that in many places the space between the cutting particles is filled with bond and the corresponding spaces in the wheel on the left are open and will give room for clearance. Continued work with a wheel that glazes increases the smoothness of the wheel face and decreases the cutting.

A wheel will not load unless the bond is too hard or it is run at a speed very much too slow. The factors that cause loading are, therefore, hard bond and slow speed. Loading may indicate that the wheel is too hard or that it is running too slow, or both.

The factors that cause glazing are hard bond and high speed. Glazing may indicate that the wheel is too hard for the work, or it may be running too fast. A wheel of the right grain and grade may glaze if run too fast, or a wheel run at the right speed may glaze if it is too hard for the work. In short, a wheel loads when it is too hard or when it runs too slow, and a wheel glazes when it is too hard or runs too fast.

One remedy for loading is to increase the speed. A remedy for glazing is to decrease the speed. If the speeds are right, use a softer wheel in either case.

Loading and glazing make excessive dressing necessary, and excessive dressing wears wheels faster than grinding. Were it possible to obtain an ideal wheel for each kind of work, theoretically dressing would not be necessary as the face of the wheel would automatically sharpen itself.

A Wheel out of True Should Be Frequently Dressed

Whenever the work is of such a nature as to cause the wheel to run out of true, frequent dressing will save the wheel rather than waste it. For example, a wheel that ran out 1/32 of an inch after one hour's grinding ran out ⅛ of an inch after two hours grinding. Had it been dressed after the first hour and again after the second hour, the amount wasted by dressing would have been 1/16 of an inch, whereas after the wheel ran two hours it was necessary to dress off ⅛ of an inch or twice as much.

Wheels should be kept in perfect running condition, in order to give good results and a wheel should never be used until the operator is sure the wheel runs true.

We can never grind perfect work with an imperfect wheel, and the more perfect and smooth the wheel is the more perfect and smooth will the work be, particularly when making the light finishing cuts.

Dressers and Truing Wheels

Dressers should always be kept handy for wheels for off-hand grinding but for truing wheels on plain, cylindrical and universal grinding machines, cutter and reamer grinders, etc., a diamond is necessary for good results.

Dressing is not truing, but sharpening the wheel, and a dresser should never be used on wheels that grind round work on centers. When truing a wheel for round grinding, the diamond should be held in a rigid tool post on the table of the machine. You cannot do good work with a wheel that has been trued "by hand." When a dresser is used, it should be moved in a straight line across the face of the wheel, with the heel of the dresser resting firmly against the edge of the work rest.

It may be well to state here that dressing is sharpening the wheel, and truing means to perfect the wheel—make a perfect cylinder of it, which is absolutely necessary if it is intended to grind a perfect cylinder with it.

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American Machinist

Editorial

The Papers and Discussions of Engineering Societies

The principal object of an engineering society is the consideration of engineering questions and the distribution of engineering information so as to be of use to engineers at large. While this of necessity involves the consideration of commercial machines in order to be of the greatest value to the engineering world, such consideration should deal entirely with the principles involved and the results obtained without invidious comparison with others of the same type. In other words, the exploitation of any machine or what is perhaps more commonly known as "commercialism," should have no part in the proceedings of any engineering society.

These principles seem to have been overlooked at the last meeting of the American Society of Mechanical Engineers, and we sincerely hope that this may never be repeated at any future meeting. It should be impressed upon every member of the society that all exploitation of any machine is out of place in any paper which he may prepare, and that the society meetings are for the discussion of principles involved in machine construction rather than the advantages or disadvantages of certain makes of machines. When this is thoroughly appreciated by the members, it will be much easier for the committee in charge to secure proper papers to be presented.

But until that time arrives, it is very necessary that this committee exercise extreme care to see that no paper contains references to other machines or types of machines which might be considered as an attack on the commercial value of machines already manufactured. For, when a society permits the presentation of a paper which reflects directly on the machines built by a competitor, it cannot properly prevent a reply from the competitor along the same commercial lines, as a member certainly has the right to defend his own product when attacked.

In this connection it would also be well if every member engaging in the discussion, who is in any way interested in the device being discussed, should state his connection with the device or company in question, so that his remarks may have their proper weight and due allowance be made for unintentional bias, which it is so difficult to overcome.

It is time that a decided stand be taken against the exploitation of commercial products, either in papers presented or in discussions on these papers, although we appreciate that it is a rather delicate task for both the committee who must pass on the papers, and the chairman, who must decide while the discussion is under way, whether or not it is suitable for a society of this kind. While objectionable papers and discussions may be edited or eliminated from the published proceedings, it is far better to prevent their presentation, as the time of the members is far too valuable to be wasted in this way.

We believe that the true solution of the problem lies with the members themselves, and we feel sure that when they carefully consider the matter in a broad way, they will not seek for the commercial advantages which they might secure from objectionable exploitations, but will work instead for the general good of the society as a whole.

Working Drawings for Gears

The following paragraphs were written by a mechanical engineer who has had many years' experience in designing and producing gears. They sum up his observations of the inadequacy of many drawings of gears that are sent out for estimates and as working drawings. The underlying principles that a working drawing must be clear and complete are in no wise restricted to gears, but apply to all machine parts.

If it were realized just how much a proper drawing will facilitate production, or if due appreciation were had of the delays that are caused by lack of such drawings, there would be a decided change from present practice. Many draftsmen seem to try and see just how many gears they can crowd on one sheet; the gears are shown in mesh and working dimensions are conspicuous by their absence. Sometimes a blank sketch is shown with a long list of dimensions filling the rest of the print; the gears listed may be made of three or four different kinds of material. This may be very nice from the draftsman's standpoint, but how about the workman who has to trace out all of these necessary dimensions? The pitch diameter and backing of bevel gears from the pitch lines are necessary dimensions—for the draftsman—but they are of no

interest to the workman. Someone has to put drawings of this kind in shape before they can go into the shop as working drawings; perhaps new ones must be made. All of this takes time and means a delay at the very beginning of the job, and the more difficult the work the longer the delay.

If a print of this kind reaches the shop, there may be a dozen patterns to be made and several blanks to be forged; but the gears are all shown on this one print. No work can be done on the forgings until the patternmaker is through with the print, and the time taken to make and check the patterns is lost as far as the steel gears are concerned. With separate drawings the forgings might have been in the machine shop at the time the patterns were finished. When the machine work is started there is one print from which all of the dimensions and operations for a dozen gears must be taken.

If the draftsman had spent some of the time used in drawing standard gear teeth —to which no attention is paid—on essential dimensions, the work could now progress more rapidly. A description of the style of tooth is all that is necessary, unless the tooth is very special. And unless a special form of tooth is desired it is best to show none at all, otherwise another delay will be necessary to find out just what is wanted.

A gear drawing should show all of the necessary working dimensions. No figuring whatever should be required of the workman.

When special material or special treatment is to be used, always put this information on the drawing in full; also give working limits and specify surfaces that are to be ground, as well as those upon which no finish is required. It is often advisable to show adjacent parts in dotted lines, so that better judgment can be used in the machine work of parts that are to run together.

Above all things make the drawings clear and complete; put each gear upon a separate drawing, especially if they are to be made in quantities. When a workman is making a gear he is interested in that gear, not in its mate.

Convention of the Engineers' Society of Pennsylvania at Harrisburg

On June 1, 2, 3 and 4, at Harrisburg, Penn., there was held the second annual convention of the Engineers' Society of Pennsylvania, the meetings being conducted in the hall of the House of Representatives of the State Capitol, by special invitation of the Legislature.

The primary object of this society is to band together into a State federation all local engineers' clubs of the various cities of Pennsylvania, not so much for their own good or that of the members as for the purpose of employing their technical training and knowledge for the furtherance of the best interests and welfare of all the people.

It is contended that most public affairs really belonging to the domain of engineering are now advocated, directed and backed by men who are not engineers. In fact, this work seems to have been left to the lawyers and physicians, while the engineer has confined his meetings to discussions of interest to himself only, and solely for his own enlightenment.

Recommendations were adopted that standing committees be appointed to interest themselves in, and make annual written reports to the State convention on all the various public utilities, such as structures, lighting, power, water supply, sanitation, roads, railroads, waterways, industrial education, conservation, telephone, telegraph, mines and mine safety, mineral lands, legislation and sociological problems.

Another object of the federation of engineers' clubs of the State is for the perfection and adoption of a code, such as is effective among physicians, and to draft legislation whereby all properly entitled to the appellation of engineer can be authorized to practise as such in Pennsylvania.

The various meetings were presided over by Prof. John Price Jackson, dean of the engineering school, State College.

Numerous lectures were given dealing with good roads, the Melville-MacAlpine Reduction Gear, the by products of the producer, building and street illumination, rotary blowers, the atmosphere with reference to aviation, and sanitation.

There were between six and seven hundred men registered as in attendance, upon the convention. An extensive exhibition of machinery and supplies was also held during the four days.

Recording Machines Wanted

Who makes a device that will record, on paper, the revolutions or strokes of a machine, so that at a glance the time in operation, the speed and the idle time can be seen? An electrical device with the make and break part on the machine and the recorder in another part of the building preferred.

"Carbureters and Engine Troubles," a handy text book for those who use gasolene motors, and published by the Breeze Carbureter Company, Newark, N. J., at ten cents a copy, has reached its fourth edition.

Obituary

W. P. Bettendorf, president of the Bettendorf Axle Company, and a well known inventor and designer of special machinery, particularly of the mammoth class, died at his home in Davenport, Iowa.

Mr. Bettendorf was born 53 years ago in Mendota, Ill. In 1874 he started his mechanical career as a machinist's apprentice in the shops of the Peru Plow Company. In 1882, after spending part of the intervening years in other shops, he returned to the Peru Plow Company as superintendent.

In 1886 he, with his brother, J. W. Bettendorf, established the business of the Bettendorf Metal Wheel Company, Davenport, Iowa, for the manufacture of the metal wheel for agricultural implements which he had invented. A few years later he invented his pressed-steel gear for farm wagons and in 1895 the Bettendorf Axle Company was incorporated for the manufacture of farm vehicles, which business was soon purchased by the International Harvester Company. Mr. Bettendorf then directed his attention to the manufacture of steel car trucks and underframes, as well as complete freight cars. It was in this particular line, the largest of his several enterprises, that Mr. Bettendorf's influence and mechanical ability were mostly felt.

In 1902 his manufacturing interests were centered in a new plant in Bettendorf, a town a few miles outside of Davenport.

Personals

George B. Foster has been appointed Chicago sales manager of the Wisconsin Engine Company, Corliss, Wis. His offices will be located in the Fisher building, Chicago, Ill.

L. G. Mong has resigned his position with the Erie City Iron Works, Erie, Penn., to accept the position of assistant general manager of the Titusville Iron Company, Titusville, Penn.

John R. Allen, professor of mechanical engineering at the University of Michigan, has accepted the post of director of the department of engineering, Robert College, Constantinople, Turkey.

William O. Barnes, formerly assistant superintendent of the Miller Lock Company, Philadelphia, Penn., has joined the Iver Johnson Arms and Cycle Works, Fitchburg, Mass., and will act in the capacity of mechanical engineer.

John J. Chisholm, until recently chief engineer of a branch station of the New York Edison Company, has accepted the position of superintendent of power of the Westinghouse Electric and Manufacturing Company, Pittsburg, Penn.

New Tools and Shop Appliances

A Reaming Machine for Chambered Holes

The difficulty of obtaining a true hole when reaming in a lathe or drill press, particularly when the parts to be reamed have chambered or relieved holes is well known; in the latter case it is almost

A Reaming Machine

impossible to get the two ends of the hole to line up, even though floating reamers be used for this purpose. In order to overcome these difficulties, the Hoefer Manufacturing Company, of Freeport, Ill., has built, for use in its own shop, the reaming machine shown in the accompanying illustration.

The metal cover fastened to the base incloses a bracket carrying a bevel gear and pinion transmitting the power from the pulleys shown, to the spindle of the device. The key or drift hole of the spindle is shown just below the cone pulley. The end of the spindle, which points upward, fits a No. 3 Morse taper and holds the shank of the reamer arbor. On this arbor an adjustable shell reamer is placed and at the upper end of the arbor, just above the reamer, a small pilot is provided which enters into the guiding arbor above it. This guiding arbor is in turn held in the nonrotating spindle carried by the column. As shown in the illustration, a rack is attached to this spindle by means of which it can be raised and lowered by the wheel and lever shown.

The device is used for reaming spindle sleeves, pulleys and the holes of various gears.

In operating the reaming machine, the upper nonrotating spindle with its guiding arbor is raised, and the pulley is slid onto the arbor. The spindle is then lowered until the guiding arbor engages the pilot on the end of the reamer bar, and the operator starts up the machine, holding the cone pulley with both hands on opposite sides of the rim. As the lower spindle rotates, he exerts a slight pressure on the pulley, thereby feeding over the reamer until the latter comes through at the top. In the illustration a pulley is shown finish reamed, the reamer being visible at the upper end of the pulley, which is supported by the shank of the reamer arbor.

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

Wheel Brushes

The American Wire Brush Company, 277 Greenwich street, New York, is placing on the market a new form of circular brush. It consists of narrow rings or washers with bristles of any suitable material. These washers are strung on the polishing arbor and in this way a brush of any desired width can be built up.

The Farwell Portable Molding Machine

The halftone shows a 30-inch portable Farwell molding machine built by the Adams Company, Dubuque, Iowa.

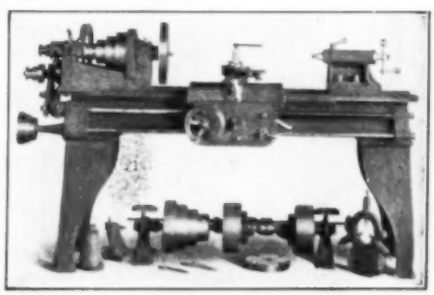
This machine is of the squeezer type. The shelf at the back is for the molder's

A Portable Molding Machine

tools and the one at the side for the work, flask, etc., so as to avoid unnecessary stooping and waste of the molder's time.

A 14-inch Engine Lathe

The halftone shows a new 14-inch engine lathe which has just been brought out by the Young Machine and Tool Company, Worcester, Mass. It swings 16 inches over the bed and 11 inches over the carriage. The hole in the spindle is



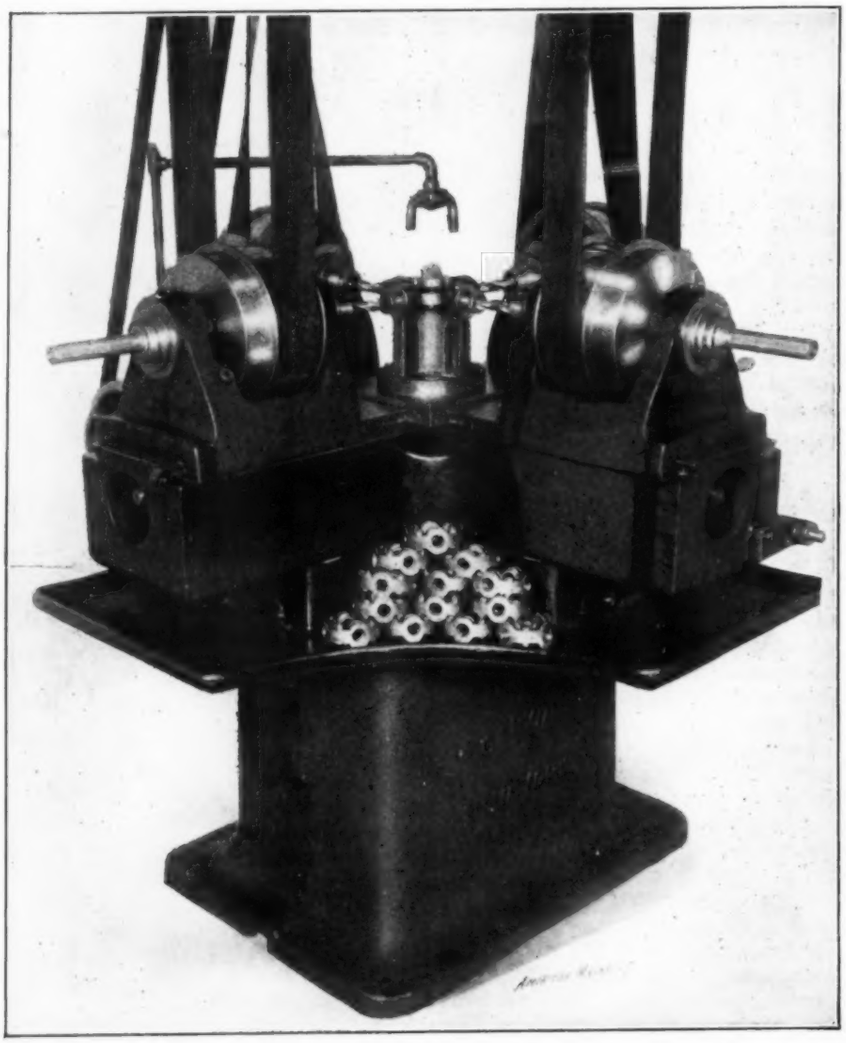
A 14-inch Engine Lathe

1⅛ inch. With six-foot bed the distance between centers is 36 inches and the weight 1470 pounds. It is impossible to throw both the rod and screw feed in simultaneously. All bearings are of cast iron hand scraped. It may be had with taper attachment and gear cutting attachment at extra cost.

A Four-head Right-angle Drilling and Turning Machine

This machine was especially designed in anticipation of the constantly growing demand for special machinery for finishing bevel-gear differential spiders and housings and universal joints and rings.

The illustration shows the machine operating on universal joint rings, drilling all four holes simultaneously, the ring being held in a quick-clamping fixture which carries bushings to guide the drills or reamers. After a quantity have been drilled, the drills are replaced by reamers, the reaming operation being identical to the drilling.



A 4-HEAD RIGHT-ANGLE DRILLING AND TURNING MACHINE

The drive to the machine is taken from a four-way right-angle countershaft, four wide belts coming down to the spindles, which run in bronze bearings of large diameter, provision being made for take-up for wear. The spindles have a threaded nose, to allow for round box tools being used. The spindles also carry on their inside a drill spindle, provided with a Morse taper hole in its forward end to receive drills or reamers. This drill-spindle is clamped inside of the main spindle, in a true running position, by a simple rack-clamping device, which passes through the rear of the drive pulley. These spindles may be adjusted in or out very quickly.

The four heads are gibbed to the bed with taper gibs, which have slots in their rear end, that interlock with the gib-adjusting screw. On the under side of each head, and in the center, is mounted a bracket, carrying the feed nut, which is so constructed that the heads may be independently adjusted to or from the center, the nut being then clamped to the bracket, through the socket screw shown on the side of the rear spindle bearing. This feature allows for a very fine adjustment being made, such as is necessary in facing shoulders.

The bed is of cross shape, and in its center is mounted a jig-plate for clamping the fixture.

On the side of the bed, and in the position the operator stands, are mounted the operating and tripping rods, which connect with the rocker box carrying the worm meshing with the gear on the feed screw at the rear of the head, the feed drive being taken from the countershaft.

The tripping device is constructed so as to trip the power feed on facing shoulders, reducing inaccuracy in length to a minimum. An adjustable collar is provided for the tripping device.

The base is of pan-type construction, providing ample space for chips. The proper lubricating of cutters and work is provided for, the oil being contained in a reservoir in the base, having a double straining system. It pumped from here to the points of operation.

A cover is mounted above the tools, and as the oil is turned on, automatically takes its position, covering the tools, eliminating any splash of oil. As the oil is turned off, the cover raises, allowing ample room for the operator to put in and take out the work.

The maximum distance between nose ends of spindles is 10 inches, each head having a power feed travel of 4 inches. The return of the heads is by hand-wheel, placed in a convenient position for the operator. Maximum size of drill in steel, ⅞ inch.

The machine weighs 2800 pounds and is manufactured by the Garvin Machine Company, New York.

An Irregular Match Plate and Flask

Fig. 1 shows an irregular match plate containing twelve stove-lid lifter patterns.

FIG. 1. IRREGULAR MATCH PLATE

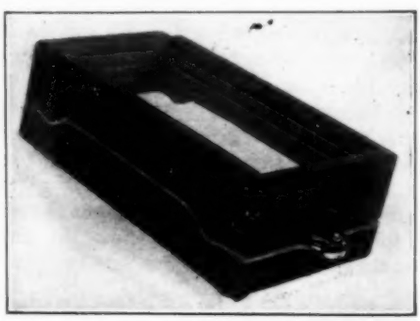


FIG. 2. IRREGULAR MATCH PLATE ON FLASK

The plate is provided with ears which fit the pins of the flask and prevent shifting. Fig. 2 shows the flask with match plate in place. This arrangement of irregular match plate and flask is made by the Adams Company, Dubuque, Iowa.

Details of Gnome Aeroplane Motor

By Warren H. Miller

A European gasolene motor with radial cylinders which revolve about a stationary crank shaft. The various connecting rods swivel on pins held in a crank pin frame, which, itself surrounds the main crank pin. The gas inlet is through the hollow shaft and inlet valves are in the pistons.

The principal idea in the design of this motor has been to get lightness by selecting only materials of such strength that fine, thin working parts can be used, which will be exceedingly strong and tough, and yet, in the aggregate, lighter than if made in some material intrinsically light, such as aluminum. This latter metal is not used at all, even in such parts as the crank case. To get exceptionally uniform rotation without a flywheel, no reliance was placed on the fact that at least two of the cylinders are executing a power stroke all the time, but the cylinders themselves were made to act as a flywheel, thus using their weight to aid in securing uniform rotation. That such uniformity is well worth having, particularly in aëroplane service, has been often demonstrated by breakages of screw propellers with other motors, there being no assignable cause for such breakage other than the fatigue and crystallization of the metal of the screw under the repeated shocks of the cylinder efforts in the absence of adequate flywheel capacity to absorb such shocks.

To use the cylinders themselves as a flywheel, introduces two problems: That of overcoming the centrifugal forces tending to hold open the poppet-valves of the piston intakes, and that of providing means to get any cylinder off quickly and yet have it secured so absolutely that there would be no possibility for it to fly off. The use of bolts would hardly do, for these have not only the centrifugal tension against them, but the shocks of explosion, and would eventually unscrew or snap off. The cylinders are of machine steel forged in the rough and turned out complete, vanes and all, from the block. A ring groove is cut in the surface where the mouth of the cylinder enters the case, and the cylinder is a friction fit until it brings up against a slight shoulder, with this ring groove showing inside the case. A steel snap ring is then put on inside, locking it, and this is held on by keys, belted through the case between each pair of cylinders.

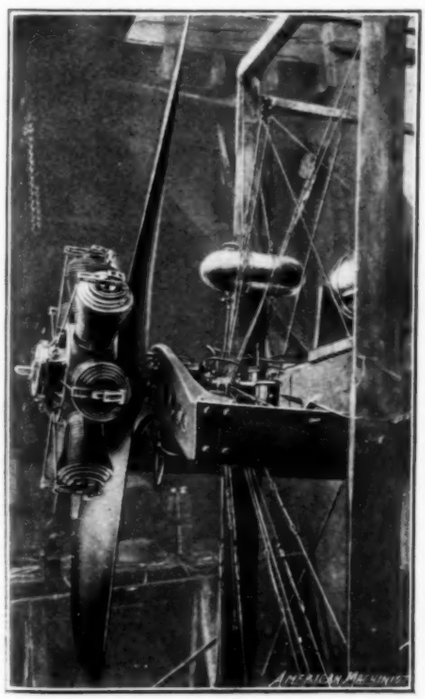


FIG. 1. GNOME MOTOR MOUNTED IN TESTING FRAME

As the case itself must revolve about the crank shaft, on the latter are placed cylinder-bearing housings, similar to the races of ordinary ball bearings. These can be seen assembled in Fig. 5. The two end pieces, shown in the same view, draw on over these housings thus putting the weight of the case upon them.

In the 30-horsepower size there are five cylinders; in the 50-horsepower, seven cylinders; and the 100-horsepower size has 14. The connecting rods all bear on a central master bearing, which fits on the crank pin and itself carries seven small crank pins, as shown in Figs. 3 and 4. The piston end of the connecting rod terminates in a bell, with thread, permitting the intake valve to screw into it, and at the same time include the piston head between them. To assemble, the wrist pin is inserted after this bell is screwed into the valve seat, thus preventing any part of it from unscrewing. The centrifugal force of rotation is automatically cared for by the two small counterweights which will be noted in the valve seat in Fig. 4. These act to hold the valve shut, and are of such proportions relative to the spring and the natural intake pressure, that the centrifugal force of the weight of the valve itself is balanced by them at all speeds. All these reciprocating parts are machined out of solid nickel-steel forgings.

The escape valves are in the cylinder heads, open inward, and are mechanically operated by the rods and cams shown in the halftone of the Gnôme motor mounted on the testing stand, Fig. 1. The end of each rod with four-to-one reduction gear and operating cams, is shown assembled with the rear end of the crank case in Fig. 5. The cooling is entirely by air, which is cut at great velocity by the cylinder vanes, and the propeller is mounted directly back of the motor.

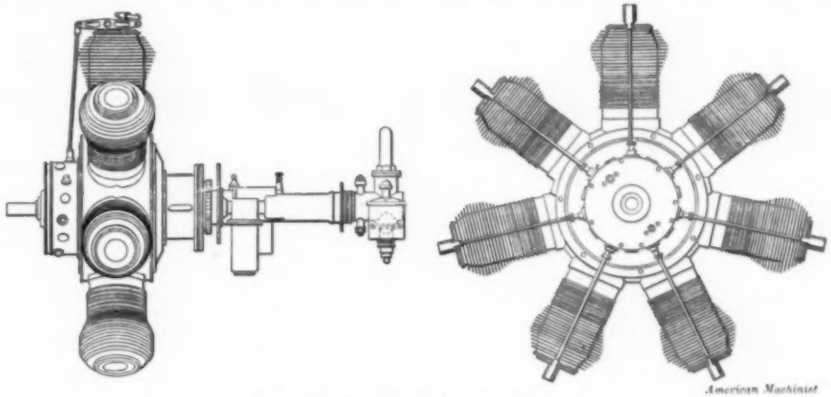


FIG. 2. GENERAL ARRANGEMENT

The crank shaft is hollow and has an ordinary float-feed carbureter, which in-

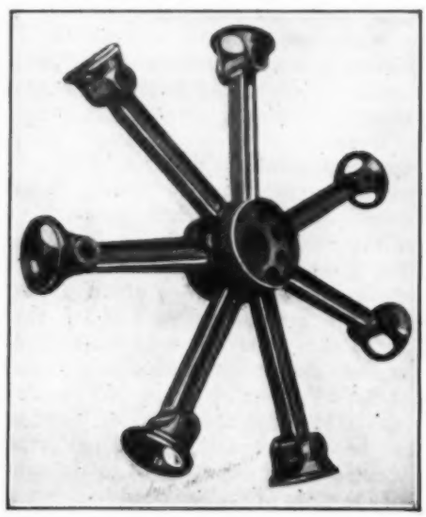


FIG. 3. CONNECTING RODS AND CRANK PINS OF GNOME MOTOR

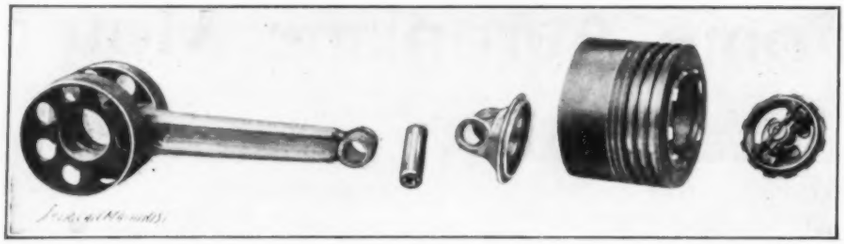


FIG. 4. CRANK-PIN FRAME, CONNECTING ROD, PISTON AND INLET VALVE

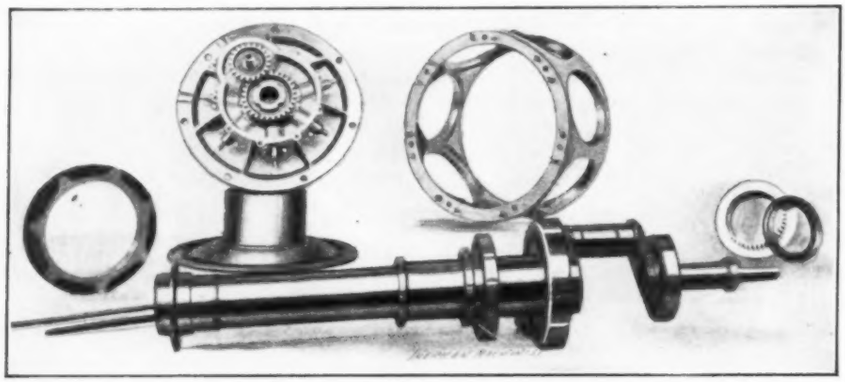


FIG. 5. GNOME MOTOR CRANK SHAFT, CASE AND END FRAMES

troduces the mixture directly into the crank case, from which the seven intake valves receive it, after the stroke which scours out the exhaust. The ignition is by spark plugs, which project some distance into the cylinder to avoid being flooded by the oil which comes along the cylinder walls. A sevenpoint timer encircles the crank shaft, and, secured to it, ignites the cylinders. The oil is introduced into the case by a pipe leading through the hollow crank shaft. Once inside the case it is carried by centrifugal force and suitable ducts to cylinders and pistons, while a second pipe with drip cup, lubricates the ball-bearing housings and crank pin.

Gnôme motors of the 30-horsepower size are much used on light *Demoiselle* and *Bleriot XI* monoplanes. It is 4x4-inch bore and stroke, and 1300 revolutions per minute, 132 pounds weight. The 50-horsepower size is 4½x5 inches, approximately; 1200 revolutions per minute, and 168 pounds weight. It was this latter motor with which Paulhan made the world's record hight at Los Angeles. It is extensively used in France on the Sommer biplanes, the Farmans, Voisins and No. XII Bleriots.

Gyroscopic action of so large a weight turning at such a speed is sometimes spoken of as seriously affecting the monœuvering capacity of the aëroplane. The death of Delagrange even was attributed by some parties, to this cause. As a matter of fact, very little actual effects of such action are commented upon by the pilots themselves, and the motor is a favorite on all the many large aërodromes of France, its type is in almost constant use.

Caliper for Hexagons and Squares

By Frank S. Bunker

The tool here described is a combination caliper used to determine the exact size that a certain piece of round stock will "hex" or square. It will give in a moment's time the exact size of the full square for a tap, having given the diameter of shank. In Fig. 1, *C* to C_1 is exact size across flats, of the square of the shank whose diameter is *A to* A_1. For tool-room work it is almost indispensable and is something any mechanic can make in spare moments.

Having determined the length of leg most suited to the work at hand, set a pair of sharp-pointed dividers to that measurement and describe (preferably on a sheet of tin) a circle as *D-A-X-Y-Z*, Fig. 2, with radius = 3 *A*, Fig. 3. Without changing the setting of the dividers, step off in the upper half of the circle, the half of the inscribed hexagon and connect these points with scribed lines as *A-X*, *X-Y*, *Y-Z*. Next lay off the sides of the inscribed square in the lower half of the circle as *A-D*, *D-Z*. Drop perpendiculars from the center 3 to the center of the sides of the inscribed hexagon 3 *B* and the square 3 *C*. These perpendiculars or distances from the center 3 are the measurements used, together with the radius 3 *A* to ascertain the location of the points *A B C*, and $A_1 B_1 C_1$ in the extended tool, Fig. 3.

Care should be taken to have the three points *A*, *B* and *C* on each leg, all in a perfectly straight line from the outer point to the center of the pivot hole, as all six points should be in contact when the tool is closed.

To use it as in Fig. 1, set the outer points *A*, A_1 to the diameter of the work to be squared or "hexed" and the points *B* to B_1 will give the exact size the piece will "hex" while the points *C* to C_1 will give the size to which the piece will square.

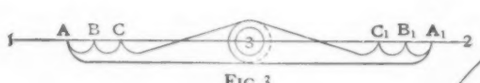


FIG. 3

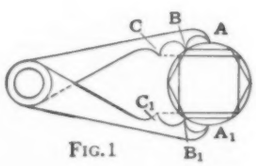


FIG. 1

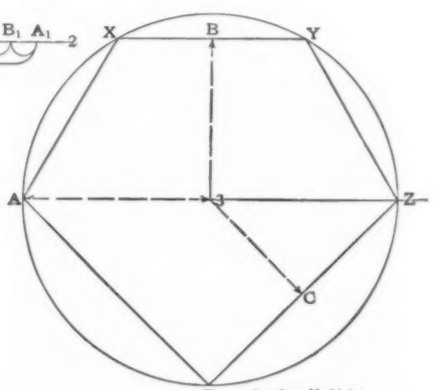


FIG. 2

THE CALIPERS AND THE METHOD OF LAYING OUT HEXAGONS AND SQUARES

Machining a Water Meter Case

By A. B. Mann

A method of tooling a Potter & Johnston Automatic lathe so as to handle water meter cases in two operations.

The illustrations, Figs. 1 and 2, represent first and second operations in machining the lower case of a water meter, on a Potter & Johnston "automatic." Great accuracy must be obtained on this meter, as there is no allowance made for scraping the case to take the valve or ball that fits into it. The distance from *A* to *B* must be within one quarter of a thousandth; and the thickness between *B* and *C* must be to the same limit. The distance from *D* to *A* must be accurate, and no limits are allowed whatever. The ball must fit perfectly in *D* with a bearing all over so as to prevent any leakage of water. The angle *E* is not so particular, there being allowed two thousandths play on that part, as the water runs between that portion of the surface and the valve. The curved surface *F* must be to a perfect radius and the maximum limit is one quarter of a thousandth, plus and minus.

The machine is equipped with a set of special cams for the cross slide and turret. The special cams for the cross slides operate the push rods in the tools.

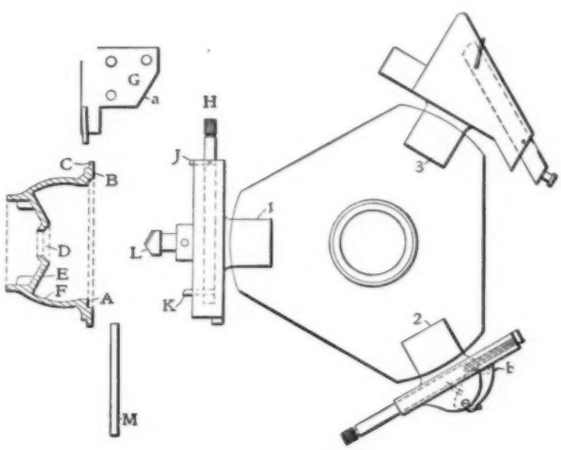


FIG. 1 1st Operation

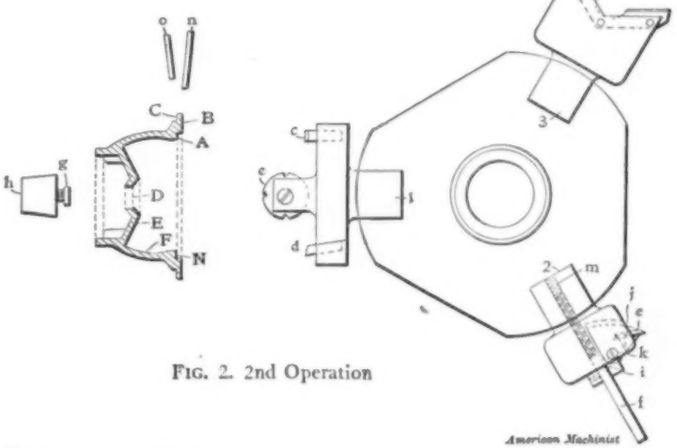


FIG. 2. 2nd Operation

MACHINING A WATER-METER CASE

THE FIRST OPERATION

The piece is held for the first operation, Fig. 1, by means of a draw chuck. Then the turret is brought forward by means of the cams and the cross-slide cams begin their operation, the turret cams having a dwell.

The block *G* is moved forward until it comes in contact with the push rod *H*. In the block there is inserted a tool which roughs the back of the flange *C*. The block continues to move forward until the cutters *J* and *K* machine the flanges *B* and *A*. In the meantime the drill *L* has drilled out the hole in the case. The rod *M* is fastened in a bracket on the base of the cross slide to secure rigidity; as the tools come forward a small hardened block that is fastened upon the tool block comes up to the end of this rod.

When the tools *J* and *K* have done their work, the rear cross-slide block is moved backward by means of a return cam on the drum, relieving the tools from the work. At the same time, the turret is returned by means of a cam on the face of the drum.

The surface *a* cut away at an angle on the block *G* allows the push rods on each tool to slide back to prevent the tools from striking, as they are pushed back by a spring.

MACHINING SPHERICAL SURFACES

To machine the surface *F* and the ball seat *D* the arc tool No. 2 is used. First, find the exact radius of the ball with a perfect bearing. Next get the exact depth of the ball from the shoulder *A*. When this is done the tool *b* may be put in the block, and then allowed to go over the piece. The tools must be set out further, or put back, according to where the gage touches on the case of the machine.

To machine the cone *E* the slide tool No. 3 in the turret is used. The operation of all these tools is accomplished with the block *G*. The proper depth for the cone tool is obtained by moving the tool backward or forward, until the right depth is obtained.

SECOND OPERATION

The second operation for this case is performed with the tools in Fig. 2. The case being machined all over within 5 thousandths leaves very little for the finishing tools to take off, which insures the longevity of these second operation tools, and causes all the cases in a day's run to come out to uniform dimensions.

When the case is placed in position the ball seat and shoulder tool No. 1 is moved forward in the turret to the cutting point. The tool *c* is for finishing the shoulder *A*, the cutter *d* for turning the inside diameter *N*. The cutter *e* is for finishing the seat *D*. This cutter is adjustable and held in place with a screw as shown. To machine the surface *F*, tool No. 2 is employed.

The push rod *f* comes in contact with the stop *g* in plug *h* in the spindle and is forced in by the turret moving forward. The push rod *f* has a slot in which the pin *i* is a sliding fit. This pin is fastened into the block *j* which swings on the pin *k* to which cutter *l* and its tightening screw are also attached. When this push rod is pressed in, it causes the tool to work on the correct radius. To insure the correct position of this cut the whole block is just simply moved backward and forward, and to insure a correct and clear corner between the cone and the spherical surface the adjusting screw *g* may be brought out further or screwed in accordingly. The spring *m* will push back the swinging tool when the turret is withdrawn. For finishing the cone the cutters in head No. 3 are provided. This tool is adjusted the same as the others and while machining the cone, the two side tools *n* and *o* finish the flanges *B* and *C*.

The Draftsman's Stomach

By F. G. Higbee

How many of us have seen the concavity of the human anatomy caused by the draftsman leaning against the drawing board? How many of us have seen the shiny spots along the waist line on trousers or vest, indicating where there has been steady wear against the board? How many of us have seen or heard of this man or that man who had to quit the board on account of his health?

There are a goodly number of men who are guilty of a senseless abuse to the body and are not aware of it. Draftsmen, look about you at your companions and note how many of them are using the stomach in this improper and injurious manner, then bear in mind that not only ordinary stomach disorders but serious diseases, one of which is called shoemaker's ulcer, may result from this practice.

There can be no doubt that drafting is hard work, but it is hard to understand why so many draftsmen will continue to use that part of their anatomy for a support. They must be aware that it is injurious, but if they are not, I hope that I have called their attention to the fact.

When it is necessary to lean on the board while lettering or hatching, I lean on my left arm. Any draftsman can learn to do his work without leaning against his stomach and every draftsman should.

Increasing Shop Capacities

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

Lester Williams has organized a company at Beeville, Tex.

The Regal Motor Company will erect a plant at Windsor, Ont.

The Bradentown (Fla.) Cutlery Company will move to Palmetto, Fla.

The Burlington (N. J.) Water Works will build a new filtration plant.

The Danville (Ill.) Water Works is to install a new water wheel, etc.

The Stoughton (Wis.) Boat Company is looking for another location.

The Sweeney Packing Company will build a plant at Sweetwater, Texas.

The Lawrence (Mass.) Dye Works will build an addition to its plant.

The Victoria (Texas) Manufacturing Company will build a sugar mill.

The Detroit (Mich.) Stove Company is building additions to its plant.

George E. Munson & Co. will start a jewelry shop in Providence, R. I.

The Pennsylvania Railroad will build a new roundhouse at Cambridge, Md.

The Wilbur Iron Mines Company will build a $500,000 smelter at Kingston, Ont.

The Electric Dynamic Company, Bayonne, N. J., will build a two-story addition.

The Augustine Rotary Engine Company, Buffalo, N. Y., will enlarge its plant.

The Oswaid Motor Company, Goshen, Ind., will erect two additions to its plant.

The city of Worland, Wyo., will establish a waterworks system to cost $40,000.

Penmans, Ltd., of Paris, etc., will establish a branch underwear factory at Ayr, Ont.

The Augusta-Aiken Railway Company will enlarge its power station at Augusta, Ga.

The Sebring (Ohio) Auto Company is to erect a plant which will employ 700 men.

The Cleveland (Ohio) Chain and Manufacturing Company will erect a new factory.

The Union Twist Drill Company, Athol, Mass., is planning an addition to its plant.

E. J. Stanzie, of Temple, Texas, will build a brass and iron foundry at Corpus Christi.

J. E. Young, of San Antonio, Tex., will build a pickling plant at Corpus Christi, Tex.

The Cleburne (Tex.) Foundry Company will build a plant. C. W. Breech is president.

The Model Stove Company, of Indianapolis, Ind., is to erect a plant at Des Moines, Iowa.

The Agar Packing Company, Des Moines, Iowa, will establish a plant at Enid, Okla.

The Reading (Penn.) Steel Casting Company is to erect a branch plant in Bayonne, N. J.

The National Twist Drill and Tool Company, Detroit, Mich., is erecting a new factory.

The Robert Boiler Company has commenced erection of a new plant at Queen Junction, Penn.

The United States Packing Company, of Chicago, will build a plant at Wichita Falls, Texas.

O. A. Kentner and others, of Sapulpa, Okla., will establish a brick plant at Wichita Falls, Texas.

The city of Houston, Texas, contemplate extensive improvements in the waterworks system.

The Palmerston (Ont.) Cold Storage Company will equip a plant with uptodate machinery.

The House of the Good Shepherd, Denver, Colo., will build a $20,000 power house and laundry.

The Rock Island Railroad will build a power plant, roundhouse and repair shop at Wichita.

The Springfield (Mass.) Foundry Company has purchased site at Indian Orchard for a new plant.

Extensive improvements will be made to the municipal electric-light plant at Coleman, Texas.

The H. G. Razall Company, Milwaukee, Wis., blank-book manufacturers, will erect a new factory.

The New York Belting and Packing Company, Passaic, N. J., will build an addition to its plant.

The Michigan Smelting and Refining Company, Detroit, Mich., has purchased site for a new plant.

Additions will be erected to mills Nos. 1 and 2 of the Tremont & Suffolk mills, at Lowell, Mass.

Daniel Hewitt is at the head of a company which is to build a street railway in Cleburne, Tex.

The United States Malleable Company, of Toledo, Ohio, will establish a foundry at Wauseon, Ohio.

The Moline (Ill.) Pump Company is looking for suitable site in Canada on which to erect a branch plant.

The Pittsburg (Penn.) Dry Goods Company is looking for site on which to erect an overall factory.

W. A. Freear and M. A. Brin, Wichita Falls, Texas, will establish a furniture and mattress factory.

The Federal Railway Equipment Company, of Newark, N. J., will move its plant to Rochester, N. Y.

The United States Barbers Furniture Company, Chicago, Ill., has purchased site for a new plant.

The Tulsa (Okla.) Auto Company is preparing to erect a plant in the new Auto Heights addition.

Stremel Brothers, Minneapolis, Minn., will erect a new tin factory at Plymouth avenue and Third street.

The J. C. Silvers Box Company, Dallas, Tex., has taken out permit for the erection of a new factory.

The Schenectady (N. Y.) Shirt Company is looking for site in the Central West for large and modern plant.

F. S. Watts and M. J. Bangus will build a brick plant at Davenport, Okla., with a daily capacity of 30,000.

The Royal Weaving Company, of Pawtucket, R. I., will erect a new power house for the Darlington plant.

The American Hone Company and the Union Cutlery Company, of Tidioute, Penn., will move to Olean, N. Y.

The Strand Heater Company, Cleveland, Ohio, has increased its capital for the purpose of enlarging its plant.

The Peninsular Stove Company, Detroit, Mich., is erecting an addition to its plant, which is nearing completion.

The T. Eaton Company, Toronto, Ont., will erect and equip a five-story warehouse and garage at a cost of $63,000.

T. B. Wood Sons Company, Chambersburg, Penn., is erecting a new machine shop and will also erect a power plant.

The Field Force Pump Company, Elmira, N. Y., has let contract for the erection of a new factory at Elmira Heights.

The Electric Service Supply Company, Philadelphia, Penn., is receiving estimates on a new six-story factory building.

The Cleveland-Akron Paper Bag Company, with factories at Cleveland, Buffalo, etc., will establish a plant in Goshen, Ind.

The Lima (Ohio) Locomotive and Engin-

cering Company has had plans completed for a new foundry and power plant.

The Thames River Dye and Bleachery Company, at Bartletts, near Montville, Conn., is making extensive improvements.

The Wilmarth & Morman Company, Grand Rapids, Mich., making drill grinders, etc., has bought site for a new factory.

The Fort Wayne (Ind.) Electric Works will shortly let contract for the construction of large factory and office building.

Contract has been awarded for the erection of a four-story addition to the Stephenson Underwear Mills, South Bend, Ind.

Carl Fisher, of Indianapolis, is preparing to build a large automobile garage at Sixth and Market streets, Logansport, Ind.

P. S. Peterson, Janesville, Wis., will build a factory on property on Maple Court for the manufacture of hardware specialties.

The Hummel & Downing Company, Milwaukee, Wis., has completed plans for a waste-paper factory to cost $300,000.

The Utah Agricultural College, Logan, Utah, will advertise for bids for the construction and equipment of power plant.

The F. M. Whiting Company, North Attleboro, Mass., manufacturing silverware, will make extensive improvements to its plant.

Plans are being prepared for a blacksmith-shop building for Fred Andres, at Keefe avenue and Richards street, Milwaukee, Wis.

Western Cement and Brick Company, Wichita, Kan., will erect a $15,000 factory building at Indianapolis and Water streets.

Dodge Bros., Detroit, Mich., is planning the erection of a $750,000 plant for the manufacture of auto parts at Hamtramck, Canada.

The Huron Manufacturing Company, Constantine, Mich., manufacturing ignition devices, is looking for location for a new plant.

Frank E. Chester, Providence, R. I., has purchased property at Bellefont, R. I., and will move his fish-line factory to that place.

The Imperial Brass Manufacturing Company, Chicago, Ill., has purchased site on which it is proposed to erect a $150,000 plant.

A second-hand iron planer, five feet or wider between housings, platen 15 feet or longer is wanted. Address P. O. Box 2785, Boston, Mass.

Westinghouse, Church, Kerr & Co., 10 Bridge street, New York, is said to be preparing plans for several large railroad-repair shops.

The Racine (Wis.) Boat Company has secured site on Eighteenth street, on which large and modern boat shop will be constructed.

Messrs. Blockwilder, Holbrook, Martin and Stalford, of Hickory, N. C., will build a knitting mill at Clinton, Okla., to cost $180,000.

The Massasoit Company, Chester, Mass., manufacturing grinding wheels and specialties, is erecting a three-story addition to its plant.

The Manhattan Fireproof Door Company has broken ground for a new $50,000 factory at Lexington and Maurice avenues, Winfield, L. I.

The Northern Pacific Railroad has purchased a tract of land near Belgrade, Mont., on which, it is said, large repair shops may be erected.

The machine shop of the Consolidated Indiana Coal Company will be moved from Shelburn to Hymera, Ind., where a new shop will be erected.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 5, for 50 coaling trucks as per schedule 2585.

It is reported that Crocker, Burbank & Co., of Fitchburg, Mass., is contemplating the erection of another large paper mill in the New England section.

The Narragansett Electric Lighting Company, of Providence, R. I., has awarded contract for a three-story building at Olneyville, to be used as substation.

The Northwestern Wheel and Wagon Company, Bellingham, Wash., recently incorporated, has secured site and will soon commence erection of a plant.

The Sun Oil Company, 1212 Real Estate Trust building, Philadelphia, Penn., is looking for suitable location in the New England section for a branch plant.

The Delevan Paper Box Company, Baldwinsville, N. Y., will move to Seneca Falls, having purchased the building of the Iroquois Motor Car Company.

The Automatic Stock Pump Company, Oklahoma City, Okla., is having plans prepared for a new factory for which it is seeking site in some western town.

The Rubber Company of America, Jersey City, N. J., has purchased the building of the International Watch Company and will equip same with modern machinery.

H. Pauk & Sons Manufacturing Company, St. Louis, Mo., will erect a new three-story factory. The company manufactures show cases, barber furniture, etc.

The town of Francis, Okla., has voted to pay a bonus of $50,000 to Kansas City investors to erect an electric-light and ice plant and install waterworks.

Joseph Symonds, of Manchester, N. H., is interested in the establishment of a plant for the manufacture of automobiles, to be erected on site to be secured.

It is reported the United States Rubber Company will spend $1,000,000 in improvements at the plant of the Bannigan Rubber Company, at Providence, R. I.

The Standard Automobile Company, of Illinois, has selected Elgin for the establishment of a motor-car factory and is negotiating with the Elgin Commercial Club.

The Chicago & Alton Railroad will erect a forty-four stall roundhouse, enlarge machinery, car shops, etc., at Bloomington, Ill. About $1,000,000 will be expended.

The Monarch Electric and Wire Company, Chicago, Ill., will, in the near future, occupy a new six-story building which is now being erected at Adams and Desplaines streets.

The Josephine (Penn.) Furnace and Coke Company, which is a branch of the Corrigan-McKinney Company, will construct a new blast furnace at a cost of about $4,000,000.

The Inland Steel Company, of Chicago, Ill., is making investigation in the Central West toward securing site for the establishment of a plant for the manufacture of steel furnaces.

The Clougher Syndicate, of London, has secured site near Schenectady, N. Y., on which will be erected a plant for the manufacture of hardwood veneers, gun stocks, tool handles.

The Standard Roller Bearing Company, Philadelphia, Penn., has completed plans for a machine shop, office building and power house, to be erected at a cost of about $110,000.

The Detroit (Mich.) Auto Specialty Company is erecting an addition to be used for the manufacture of automobile sheet-metal parts. Will also install a small forge department.

Geo. W. Rurode, 1 Montgomery street, Jersey City, N. J., who is interested in the Knickerbocker Typewriter Company is said to be seeking site in the New England section on which to locate plant.

W. D. McKinney, manager of the Industrial Bureau of the Chamber of Commerce, Columbus, Ohio, is looking for a donation of about 100 acres of land to be used for the establishment of a large car plant near Columbus.

The Dayton (Ohio) Airless Tire Company is incorporating under the laws of Michigan, and will be known as the Detroit Airless Tire and Rubber Company. Plant will be erected at Detroit, Mich., which will employ 500 men.

The new merger known as the Canadian Steel Corporation will be capitalized at $25,000,000. Additions will be made at the Hamilton, Ont., plant, at a cost of $1,000,000, and will consist of new plant, furnace and steel-rod mill.

The Clarion & East Brady Electric Railway Company, Clarion, Penn., which will soon commence construction of interurban traction line, will need tools for repair shops to be built. Has also plans for a steam-turbine power plant.

The Porter-Cable Machine Company, Syracuse, N. Y., will move into the Thomas Hooker building, which it has leased and will treble working force. The company manufactures high-speed milling attachments and machine-shop accessories.

The South Bend, Ind., water works system is to be entirely rebuilt at a cost of about $50,000. An electric-power pumping station, to be erected in Leeper Park, will take the place of both the north and central stations of the present system.

Plans have been drawn for an 80,000-spindle mill for the Sharp Manufacturing Company, a new company, to be erected at New Bedford, Mass. The company is capitalized at $1,500,000. Joseph T. Kennedy, of Boston, is president, and Arthur A. Sharp, also of Boston, treasurer and general manager.

Purdue University, Lafayette, Ind., will purchase a number of new machines for new shops, including molding machine, mortising and boring machines, lathe for wood shop, steam hammer, automatic screw machine, precision boring mill, motor driven lathe for machine shop, electric cranes, pressure and exhaust fans.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: June 21—23,700 pounds steel angles, 2600 pounds track bolts (schedule 2588), involute gear cutters, 5500 pounds brass pipe (schedule 2598), dump car (schedule 2596), planing machine (schedule 2575), duplex piston pump (schedule 2576), motors, electrical supplies (schedule 2591).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 28, for electric capstans (schedule 2582), compressed-air locomotive (schedule 2578); July 5—Thirty-two worm geared blocks, 64 differential blocks, 140 dozen scoop shovels, 75,000 pounds steel floor plates (schedule 2587), 1300 pounds brass, 200 pounds copper (schedule 2602), 145,000 pounds white lead, 90,000 pounds white zinc, 7500 gallons raw linseed oil (schedule 2604), 2000 gallons sperm oil (schedule 2605).

FIRES

Logan's Tannery, Lyons Brook, N. S. Loss, $175,000.

Greenwood Mattress Factory, Greenwood, Tex. Loss, $5000.

Antony Lumber Company, South Maitland, N. S. Loss, $100,000.

Shippen Brothers, Ellijay, Ga. Lumber plant. Loss, $100,000.

Newman & Co., New Athens, Ill. Hoop and stave works. Loss, $7000.

Milligan & Plowman Packing Company, Taylorville, Ill. Loss, $90,000.

Hathaway & Reynolds, Oriskany Falls N. Y. Yarn mill. Loss, $50,000.

Manti Light and Power Company, Manti, Utah. Power plant. Loss, $17,000.

Northern Foundry and Machine Company, Sault Ste. Marie, entirely destroyed.

Union Iron Works, Spokane, Wash. Machine and boiler shops. Loss, $75,000.

International Lumber and Creosoting Company, Texarkana, Ark. Loss, $750,000.

Kokomo Brass Works Company, Kokomo, Ind. Plant destroyed. Loss, $20,000.

R. Musgrave & Son, North Sydney, N. S. Machine shop and forge. Loss, $20,000.

Cleveland Co-Operative Stove Company, Cleveland, Ohio. Partially burned. Damage, $100,000.

New Incorporations

Yardley Bronze Company, Boston, Mass. Manufacture bronze. Capital, $50,000. Edwin P. Jones, Boston, treasurer.

Queens Match Company, New York. Manufacture matches, etc. Capital, $100,000. Incorporators, M. Alderman, J. Cohen, E. M. Cohen.

Associated Foundry Manufacturing Company, Waterloo, Iowa. Gasolene engines, gray-iron castings, etc. Capital, $50,000. J. G. Phelps, president.

Cleveland Nipple Company, Cleveland, Ohio. Manufacture plumbing supplies. Capital, $10,000. Incorporators, Jesse Seidman, J. Schreiber, Joseph Apple, etc.

Rex Binder Company, Indianapolis, Ind. Manufacture paper stock. Capital, $20,000. Incorporators, O. W. Nottingham, Lewis Hoover, Edward Schmidt, etc.

Franklin Paper Company, Camden, N. J. Manufacture paper, paper materials, etc. Capital, $10,000. Incorporators, Jos. P. Murray, C. C. Robertson, F. A. Kuntz.

Johnstone, Wieber & Co., New York. Manufacture leather belting, etc. Capital, $50,000. Incorporators, W. C. Johnstone, J. Wieber, Brooklyn; J. C. Jackson, New York.

William A. Stokes & Co., New York. Manufacture and deal in woodenware, etc. Capital, $50,000. Incorporators, Wm. A. Stokes, Elmer B. Cooke, 30 Warren street, etc.

Ohio Farmers Hay Tool Company, Canton, Ohio. Manufacture hay carriers, forks, rakes, etc. Capital, $25,000. Incorporators, S. P. Lerch, L. Henry, Jos. J. Aredem, etc.

Lorraine Motor Company, Camden, N. J. Manufacture automobiles, motorcycles, etc. Capital, $60,000. Incorporators, F. R. Hansell, John A. MacPeak, Wm. F. Eidell.

Patent Manufacturing Company, Cleveland, Ohio. Manufacture and sell plated articles. Capital, $30,000. Incorporators, F. H. Wallace, C. F. Thurner, H. F. Crawford, etc.

Akron Rotary Engine Company, Akron, Ohio. Manufacture rotary gas engines. Capital, $10,000. Incorporators, Chas. E. Forsythe, Leo G. Federman, I. M. Forsythe, etc.

Paragon Sellers Company, Chicago, Ill. Manufacture and sell electrical materials and specialties. Capital, $20,000. Incorporators, Edw. M. Platt, R. E. Macduff, E. E. Dewey.

Perfect Tire Company, Cleveland, Ohio. Manufacture and sell motor cars, accessories and tires. Capital, $50,000. Incorporators, Wm. H. Egnon, W. C. Egnon, W. A. Mayer, etc.

Dyett Tool and Engineering Company, Ilion, N. Y. Manufacture tools, engines, boilers, etc. Capital, $100,000. Incorporators, Frank J. Dyett, B. B. Ross, Albert L. Johnson, etc.

Twentieth Century Portable Paving Machine Company, Chicago, Ill. Manufacture paving machines. Capital, $15,000. Edw. G. Leszynsky, 205 La Salle street, one of the incorporators.

Knickerbocker Brass Goods Company, New York. Manufacture and deal in brass goods, etc. Capital, $50,000. Incorporators, E. J. Forhan, J. J. Harper, S. F. Martin, 154 Nassau street.

Clark Motor Company, Buffalo, N. Y. Manufacture automobiles, motors, engines, etc. Capital, $50,000. Incorporators, Stanley B. DeLong, John W. Van Allen, Henry J. Bente, Buffalo.

American Pneumatic Conveying Company, New York. Manufacture pneumatic conveyers and machinery. Capital, $200,000. Incorporators, W. M. Jacobus, W. W. Ackerman, J. A. Seely.

Syracuse Pattern Works, Syracuse, N. Y. Manufacture metal patterns and castings. Capital, $10,000. Incorporators, Chas. Knapp, 845 Beldon avenue; Elmer Knise, 824 New Butternut street, etc.

Perfect Process and Tool Company, Buffalo, N. Y. Manufacture and deal in hardware, tools, specialties. Capital, $10,000. Incorporators, Wm. H. Hodson, Oscar M. Hodson, Edward D. Woods.

Dulles-Baldwin Electric Drill Company, Kerhonkson, N. Y. Manufacture and deal in drilling machinery, etc. Capital, 600,000. Incorporators, Jas. H. Baldwin, F. B. Darte, 115 Broadway, New York, etc.

Queens Boulevard Garage, Borough of Queens, N. Y. Capital, $5000. Incorporators, Geo. G. J. Glaser, N. C. Glaser, 4 Maple street, Corona, L. I.; Clarence M. Davis, 212 Clinton street, Brooklyn, N. Y.

Silas E. Pearsall Company, Newark, N. J. Manufacture phonographs, talking machines, etc. Capital, $30,000. Incorporators, Geo. L. Stilwell, Wm. H. Clements, of Nutley, N. J.; Chas. E. Levsen, East Rutherford.

Anthony Auto Body Company, New York. Manufacture and deal in auto bodies, etc. Capital, $10,000. Incorporators, Louis Greenfeld, 877 Eighth avenue; Anthony Yandrasitch, 254 West Fifty-first street, etc.

Bushey Demountable Rim Company, New York. Manufacture and deal in automobiles, parts, accessories. Capital, $20,000. Incorporators, Gerard B. Lambert, 777 Madison avenue; Ely J. Bushey, 1777 Broadway, etc.

Brooklyn and Jamaica Bay Railway Company, New York. Build and operate an electric surface road. Capital, $100,000. Incorporators, H. J. Subers, Ashbourne, Penn.; N. S. Easton, E. S. Churchill, D. Von Wien.

The Al-Ton Motor Accessory Company, Akron, Ohio. Manufacture and deal in motor vehicles, automobile parts and accessories. Capital, $50,000. Incorporators, Clyde S. Pelton, H. F. Maranville, C. H. Maranville, etc.

Behre Appointment Clock Company, New York. Manufacture and deal in all kinds of clocks, watches, meters, etc. Capital, $10,000. Incorporators, John T. Little, 308 West Seventieth street; Frank B. Carr, 1402 Broadway.

United Sewing Machine Company, New York. Manufacture and deal in sewing machines, supplies, etc. Capital, $10,000. Incorporators, Leo Kiesler, Oscar S. Pearson, 3300 Third avenue; H. A. Herold, 135 William street.

National Metallic Hose Company, New York. Manufacture hardware and hardware supplies. Capital, $130,000. Incorporators, Jas. A. Watt, 127 West Ninety-sixth street, care E. Trulock, 118 East Twenty-eighth street, New York, etc.

Mack Brothers Motor Car Company, of New York, Brooklyn, N. Y. Manufacture and deal in automobiles and accessories. Capital, $25,000. Incorporators, Wm. C. Mack, Brooklyn, N. Y.; W. J. W. Groves, Wm. F. Buchhelt, Allentown, Penn.

International Electric Protection Company, New York. Manufacture and install electric signaling and alarm systems. Capital, $5,000,000. Incorporators, F. Rhodes, S. H. E. Freund. A. M. Trueb, New York; Robert Walker, Scarsdale, N. Y., etc.

Keep-Step Motor Company, New York. Manufacture and deal in electric motors, generators, etc. Capital, $10,000. Incorporators, Ernest E. Wheeler, Yonkers, N. Y.; T. B. Johnson, 2 Rector street, New York; W. H. Wheeler, 54 Tenth avenue, New York.

Pearsall-Traver Manufacturing Company, Far Rockaway, N. Y. Manufacture nonskid device for automobiles, etc., manufacture and deal in tools, appliances, etc. Capital, $50,000. Incorporators, Lewis Pearsall, White street; Phillip C. Traver, Oak place, Far Rockaway, etc.

Taylor-May Machine Company, Rochester, N. Y. Manufacture and deal in machinery, tools and appliances. Capital, $20,000. Incorporators, Henry D. Taylor, 95 Emerson street; Harry A. May, 898 University avenue; Albert E. May, 241 Culver Road, Rochester, N. Y.

John Polachek Bronze and Iron Company, Brooklyn, N. J. Manufacture and deal in articles of bronze and iron, etc. Capital, $10,000. Incorporators, John Polachek, Elmhurst, L. I.; Louis Schmitt, Philip Schmitt, George Schmitt, 343 Madison avenue, New York.

Business Items

The annual vacation of the employees of the Jacobs Manufacturing Company, Hartford, Conn., will be in the first week of August. The shop will be closed during that time, but in order to catch up with orders it will work Saturday afternoons until August.

The Cincinnati Planer Company, having completed its removal into new buildings at Oakley, has found it necessary, owing to its greatly increased capacity, to make several changes and promotions in its organization, and in the future the company will be officered as follows: C. H. M. Atkins, president; B. B. Quillen, secretary and treasurer; Geo. D. Walker, assistant secretary and treasurer; Geo. Langen, works manager; Frank Gebhardt, superintendent; Percival Reston, chief draftsman; Charles Meiers, sales engineer.

Trade Catalogs

The Peter Gerlach Company, Cleveland, Ohio. Catalog. Saws, stave heading and barrel machinery, etc. Illustrated, 32 pages, 3½x6½ inches, paper.

Tate, Jones & Co., Inc., Pittsburg, Penn. Circular No. 129. Fuel-oil burning equip-

ments for open-hearth furnaces. Illustrated, 8 pages, 8½x11 inches.

Felt & Tarrant Manufacturing Company, Chicago, Ill. Booklet. "Rapid Mechanical Calculation," describing comptometer. Illustrated, 24 pages, 5½x8 inches.

The National-Acme Manufacturing Company, Cleveland, Ohio. Catalog. Tools and parts for Acme automatic multiple-spindle screw machines. Illustrated, 46 pages, 7x9 inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4737. Electric hardening furnace. Illustrated, 8 pages, 8x10½ inches. Bulletin No. 4732. Curtis steam-turbine installations. Illustrated, 56 pages, 8x10½ inches.

FORTHCOMING MEETINGS

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

Wanted—Two 36" Fellows gear shapers, late type. Box 619, AMERICAN MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Wanted at once, 25,000 feet ¾ x ⅝ x ⅛ steel channel; give lengths. Henry T. Adams Co., 6823 South Chicago Ave., Chicago.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

I want to correspond with some party, who would like to put on the market, a first-class water tube boiler. Address 132 South Race St., Springfield, Ohio.

Light, fine machinery and mechanical specialties built to order; jigs, tools, etc., designed and built. Goodson Electric and Manufacturing Co., Providence, R. I.

Does your gasolene motor run smoothly? If not, send 10c. postage for 56-page textbook on "Carbureters and Engine Troubles." Breeze Carbureter Company, Newark, N. J.

Wanted—Iron planer, second hand, five feet or wider between housings, platen fifteen feet or longer; give particulars, cash price, where can be seen. P. O. Box 2785, Boston, Mass.

Cincinnati shop has some spare capacity and is open to contract work for engine lathes, Jones & Lamson turrets, drill presses, milling machines and grinders. Box 633, AMERICAN MACHINIST.

Mechanical engineer or machinery man desired as partner in solid manufacturing business netting $20,000 annually; investment required; bank references furnished. Box 643, AMERICAN MACHINIST.

Wanted—To manufacture small machines, or parts; punch press, screw machine, lathe, shaper and multiple drill spindle work quoted on at reasonable prices. Joseph Pollak, 215 Sydney St., Dorchester, Mass.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Machinists' and draftsmen's handbook; second edition, enlarged and revised; over 450 pages, including illustrations and tables for $2.50; from cover to cover it is full of valuable and helpful information; invaluable to the employer as well as the workman; don't send any money; simply send your order and receive the book on trust; look it over—if you like it, keep it; act today. Address Peder Lobben, Holyoke, Mass., Box 243.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

ARKANSAS

Wanted—Two or three, practical sober machinists, with some money, to help establish and take charge of a large modern machine shop for repair work, and manufacturing saw-mill equipment, motor boat and automobile repair departments, and sales agencies; we will furnish the larger part of the capital needed, and will sell to right parties, stock, on long time payments. Address R. J. Terry, Secy. Business Men's League, Clarendon, Ark.

CANADA

Wanted—A production manager for small tool factory; state experience and salary expected. Box 618, AMERICAN MACHINIST.

Wanted—Foreman for brass finishing department in large electrical factory. Apply, stating experience, Canadian General Electric Co., Peterboro, Ontario.

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Peterboro, Ont.

Wanted—First-class toolmakers on automobile jig and fixture work; highest wages paid to first-class men; no others need apply. Reo Motor Car Co. of Canada, Ltd., St. Catharines, Ont., Canada.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—Salesmen to handle on a generous commission basis, a well advertising and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A first-class draftsman familiar with wood car detail. Box 621, AMER. MACH.

Wanted—Toolmakers, experienced on punch and die work. Apply Employment Department, General Electric Co., Pittsfield, Mass.

Draftsman Wanted—Experienced mechanical draftsman and designer on steam turbine and electrical work for permanent position; state age, education, experience and salary expected by addressing, Chief Draftsman, General Electric Co., Lynn, Mass.

Wanted—A thoroughly competent machine designer with inventive faculty and thorough knowledge of modern shop practice to work on special line of machinery. Apply by letter only, giving age, experience, reference and salary desired, to Room 809, 318 Main St., Springfield, Mass.

MICHIGAN

Wanted—A few first-class toolmakers experienced on die, jig and fixture work for light manufacturing. Box 592, AM. MACH.

Wanted—A manager with a few thousand dollars to take charge of a manufacturing plant, located in central Michigan. Box 563, AMERICAN MACHINIST.

Wanted—Immediately, first-class metal patternmakers, tool and jig makers; give reference and experience; steady work. Holm's Machine Mfg. Co., Sparta, Mich.

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—Tool-room foreman to take care of tool room employing about 12 toolmakers; must be experienced with tools for sheet-metal work, capable of designing dies, jigs, etc., for small interchangeable work; answers kept in confidence. Address, stating age, experience and salary expected. Box 615, AMER. MACH.

MISSOURI

Wanted—Chief draftsman with technical engineering training, with machine shop and foundry experience, able to produce economical results. Curtis & Co. Mfg. Co., St. Louis.

Wanted—Chief inspector; one familiar with steel bolsters and car work by large steel plant in West; one with car building experience preferred; give references and experience. Box 576, AMERICAN MACHINIST.

NEW HAMPSHIRE

Wanted—An instructor in machine work and forging; applicants must be competent, both as workmen and as teachers. Prof. of Mechanical Engineering, New Hampshire College, Durham, N. H.

NEW JERSEY

Wanted—First-class water meter general foreman accustomed to precision work; state terms and previous experience. Box 543, AMERICAN MACHINIST.

Draftsman wanted for special tools and automatic machines for light manufacturing;

must have practical shop experience. Box 617, AMERICAN MACHINIST.

Wanted—First-class water meter engineer having had experience in designing and manufacturing; state requirements, age and previous experience. Box 542, AMER. MACH.

First-class machinist or toolmaker wanted to set up drill presses, lathes, milling machines, etc., in an establishment manufacturing small electrical devices; applicant must be a man of good habits, a thorough mechanic and capable of handling unskilled help; he should also be a man who is broad enough to develop into a position as an assistant foreman; when making application, state age, experience, references, wages wanted, etc. Box 625, AMERICAN MACHINIST.

NEW YORK

Wanted—Planer hands, floor repair hand, lathe hands. Address P. O. Box 761, North Tonawanda, N. Y.

Wanted—Foreman for tool department and tool makers; state qualifications and rate wanted in first letter. The Kirkham Motor Mfg. Co., Bath, N. Y.

Wanted—Two floor inspectors in machine shop manufacturing automobile parts; do not apply unless you have held a similar position. Address Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Machinists who have had experience in setting up automatic screw machines, in a department composed of Acme, Gridley multiple and single, and Cleveland machines; on a line of very accurate work; when replying, state experience, wages expected, etc. "Automatic," Box 629, AMER. MACHINIST.

Wanted—Tool steel salesman, New York district; one who understands hardening and tempering of carbon steel and high-speed steel; also machine shop work; apply only by letter, stating experience and salary required; communications confidential. Wheelock, Lovejoy & Co., 23 Cliff St., New York.

Wanted—Foreman for machine shop in western New York, employing about twenty men, manufacturing light machinery; must be thorough mechanic and accustomed to handling men; steady employment for the right man; state experience, references, age, salary expected, etc.; replies confidential. Box 622, AMERICAN MACHINIST.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Foreman for automatic screw machine department on a line of high class, automobile work; operating Cleveland, Acme and Gridley machines; must have had experience as a foreman on this line of work; when replying, state age, experience, where employed for the past five years, and in what capacity, wages expected to start with, and date on which applicant would report for work; all replies will be treated confidentially. "Foreman," Box 628, AMER. MACH.

OHIO

Gas engine mechanical engineer; also capable selling gas engines. Box 646, AM. MA.

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Draftsmen familiar with detail crane design; state wages desired. The Toledo Massillon Bridge Co., Toledo, Ohio.

Wanted—Five first-class diemakers; those used to blanking and forming; permanent employment and good pay. Address J. C. Lester, Supt., The Davis Sewing Machine Co., Dayton, Ohio.

Expert salesman wanted by the Defiance Machine Works, of Defiance, Ohio; must be thoroughly familiar with the general woodworking trade in the United States; one conversant with wheel and wagon manufacturing preferred; applicants should be under middle age and able to give first-class references; a good position for a high-class man. Box 571, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Lathe, boring mill and floor hands; good wages, steady work. The Blaisdell Machinery Company, Bradford, Pa.

Wanted — Three first-class draftsmen on jigs and fixtures; none but first-class men need apply; state references, experience and salary expected. Lycoming Foundry & Machine Co., Williamsport, Pa.

Wanted—Jig and tool draftsmen accustomed to automobile work. Reply, giving experience, age and salary expected. Box 645, AMERICAN MACHINIST.

Machinists — Machine operators wanted; plenty of work, nothing but sober and steady men need apply. Standard Engineering Company, Ellwood City, Pa.

Toolmakers—Seven first-class toolmakers on jigs and fixtures; permanent employment. Apply, with references, to Lycoming Foundry & Machine Co., Williamsport, Penn.

Draftsman—Bright, ambitious young man, one capable of doing detail work on motors, transmissions, axles, and other automobile work; one accustomed to detailing and making finished shop drawings required; bright future. Please communicate by letter or call in person. Mack Bros. Motor Car Company, Allentown, Pa.

We are increasing our force and invite applications from machine hands of all kinds, including men who can turn multiple throw cranks, bench hands, erectors, metal polishers, and Jones & Lamson turret lathe hands; shop located near Philadelphia and building marine gas engines; no labor troubles; give experience in detail. Box 591, AM. MACH.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Experienced, practical, systematic superintendent in charge of a large manufacturing plant, wishes to make a change. Box 641, AMERICAN MACHINIST.

First class mechanical engineer (28), experienced as mechanical draftsman and assistant master mechanic, desires change; references. Box 637, AMERICAN MACHINIST.

Mechanical engineer (30), University graduate, 9 years' office and shop experience, desires a responsible position in engineering or sales department; A-1 designer and good executive ability. Box 631, AMER. MACH.

Designer with 8 years' experience in rolling mill, conveyer and transmission machinery, power plants, automatic and special machines; shop practice; technical education; interview if near Chicago. Box 638, AM. MA.

MARYLAND

By a man, 37 years, position in drafting room or machine shop; 3 years' experience as tracer and several years' experience on Brown & Sharpe plain surface grinder on small interchangeable work. Box 635, AM. M.

MASSACHUSETTS

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 608, AMER. MACH.

MICHIGAN

Mechanical structural man, eight years' experience in estimating, designing, construction and general engineering work, wishes position. Box 623, AMERICAN MACHINIST.

MISSOURI

Superintendent and works manager, A-1 automobile and duplicate parts manufacturer, experienced organizer and executive, desires change of position; at present with well advertised automobile manufacturer of Middle West. Box 632, AMERICAN MACHINIST.

NEW JERSEY

Foreman open for engagement; successful in handling help to best advantage and reducing costs of manufacturing; best of references. Box 634, AMERICAN MACHINIST.

Wanted—Position as superintendent or master mechanic; thorough technical and practical all-around designer, foreman, toolmaker and mechanic; executive ability; A-1 references. Box 636, AMERICAN MACHINIST.

Superintendent and works manager by high-class production engineer; expert on efficiency methods of organizing help and engineering the reduction of costs and raising of output; mechanical engineer by profession; expert on tools, dies, machinery and estimating; good reference for past performances. Address Hustler, Box 630, AMER. MACHINIST.

NEW YORK

General foreman, 39, up to date in modern methods of manufacture, now employed, desires change; good reference. Box 626, AM. M.

Machinist foreman, open for engagement; executive, mechanic, reliable, references; Greater New York, vicinity. Box 644, AM. M.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 640, AMERICAN MACHINIST.

Designer and engineer of proven inventive ability, graduate, 12 years' experience, fine and automatic machinery, adding machines, etc., open for engagement; any location. Address Box 604, AMERICAN MACHINIST.

Foreman machinist with executive ability, wishes a position; large experience in handling help; experienced on engines and machinery of all kinds; excellent references. Address "S. T.," 5124 Ninth Ave., Brooklyn.

Works manager, general superintendent, or mechanical engineer; 20 years' experience in all grades of shops and office work; thoroughly familiar with cost keeping, estimating, correspondence, office business practice; qualified to take entire charge; technically educated, experienced designer, first-class executive. Box 624, AMERICAN MACHINIST.

By mechanical engineer and draftsman with 7 years' experience in machine design, light automatic machinery, special machine tools, as well as rolling mills, hoisting, conveying and elevating, pumping machinery, power plants; two years assistant master mechanic; technical education; location immaterial; interview possible if in or near New York. Box 639, AMERICAN MACHINIST.

OHIO

A successful and well known superintendent will be open for engagement after August 1; am an American, thirty-six years of age, educated and of good appearance; have had fifteen years' experience in responsible positions and an exceedingly good commercial and executive training; will consider only first-class position as superintendent or works manager, or as representative of some well known machine tool company. Box 620, AM M.

PENNSYLVANIA

Wanted—Situation as superintendent or general foreman by a first-class practical mechanic holding similar position for eleven years; have a thorough knowledge of best machine shop and foundry practice; can get maximum production from men and equipment; good systematizer, accustomed to large works; good reason for changing; references furnished. Box 627, AMERICAN MACHINIST.

WISCONSIN

Superintendent wants position; high grade mechanic and executive; wide experience in designing, perfecting and developing special automatic machinery; past four years in present position; salary $3000. Box 616, AMERICAN MACHINIST.

FOR SALE

Patent for Sale—Interior micrometer, the real thing, different from any thing on market. L. Anderson, P. O. Box 729, Hartford, Conn.

For Sale—Two Gridley single spindle automatics; one Woods No. 188 automatic cutting off saw. Sullivan Machinery Company, Claremont, N. H.

For Sale—Interest or control in manufacturing business; exceptional opportunity for manager or instrument maker. Box 516, AMERICAN MACHINIST.

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; good opening for manufacturing business. Geo. H. Church, Bergen, N. Y.

For Immediate Sale—Two 26" Gisholt turret lathes, latest type, in perfect condition, fully equipped with all adjustments; one of them is a new machine which has been in use but a few months; special spindle in one takes in 5" stock, the other is standard. Standard Roller Bearing Co., Philadelphia, Pa.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.

Heavy English Equipment Tools

By I. W. Chubb

Some methods pursued in a modern English plant building heavy equipment. Among the specially interesting features are a yard crane used through roofs, gang of 12 radial drills and special 30-foot turning rig.

Travelers on the English Midland Railway, from the south toward Sheffield, will have noticed at Chesterfield one of two things, according to the side of the train on which they are sitting. Possibly the more familiar sight is the celebrated crooked church spire due, according to the story, to the fact that the devil, passing at service time from Sheffield to Nottingham, alighted on it and, sniffing the incense, sneezed to twist and bend the spire.

At the other side of the line is the cantilever crane, Fig. 1, in the yard of the firm of Markham & Co., Ltd. This crane will be referred to in detail later. The works, etc., of the firm occupy 25 acres or more. As engineers, they specialize in colliery machinery, winding plants, air compressors, larger sizes of the Sisson high-speed vertical steam engine, etc. They also do much structural iron work; steel headgear for pits, cranes of the type they themselves use in the yard, and bridge and girder work. They also manufacture colliery locomotives, rock drills, shields for tunneling, and, in fact, almost everything that is to be had in the way of colliery engineering. They employ between 800 and 1000 men.

The ordinary working week consists of 54 hours, and the system employed is mainly timework, with very little piecework, except in the boiler shop. Outside the works, the firm has provided an electrically lighted mess room for about 500 men, having kitchens, lavatories, cellars, etc., equipped by the firm. This is now managed by the workmen themselves, through a committee, 1d. (2 cents) or so a week being the subscription rate. In the evenings the buildings lend themselves to the purposes of a social club.

No attempt is here made at a set description of the works. Some features of one or two shops only, are indicated. The foundry in three bays is in process of extension, two bays being about 50 feet wide by 300 feet long, and a length of 160 feet is being added. One bay is for core making, with drying stoves, sand-mixing machines, etc. Another bay, with three 20-ton overhead travelers, electrically driven, contains the wheel and hydraulic molding machines, etc., and is for the lighter work. The bay for heavy work, with two 45-ton electric travelers, has a 20-foot diameter by 24-foot circular pit, a rectangular pit for bedplates, etc. The heaviest weight cast is about 40 tons. The cupolas are placed at about the center of the length of the building; the fan for the blast is motor driven and the hoists for lifting the charges to the cupolas are also electrically driven. Other shops form a brass foundry, repair shop, etc.

The Cantilever Crane and Movable Shop Roofs

The double cantilever crane, of German build, see Fig. 1, serves both the foundry and three other departments, including the girder shop. To that end, part of the roof of each shop is made loose and is supplied with link bolts, so that the crane can catch hold and lift it off. A special frame is formed between two roof principals to suit the loose piece. The crane itself has an over all length of 240 feet, with a lift of 90 feet clear, the hight to the top being 120 feet. With a crab at the end, 5 tons can be lifted, while half way out 16 tons can be supported. A balance weight will be noted which runs in or out, according to the motion of the crab. The whole is mounted on a table 35 feet in diameter, on which it turns. In addition, it travels on four-wheel bogies, the legs being about 32 feet apart, with two tracks

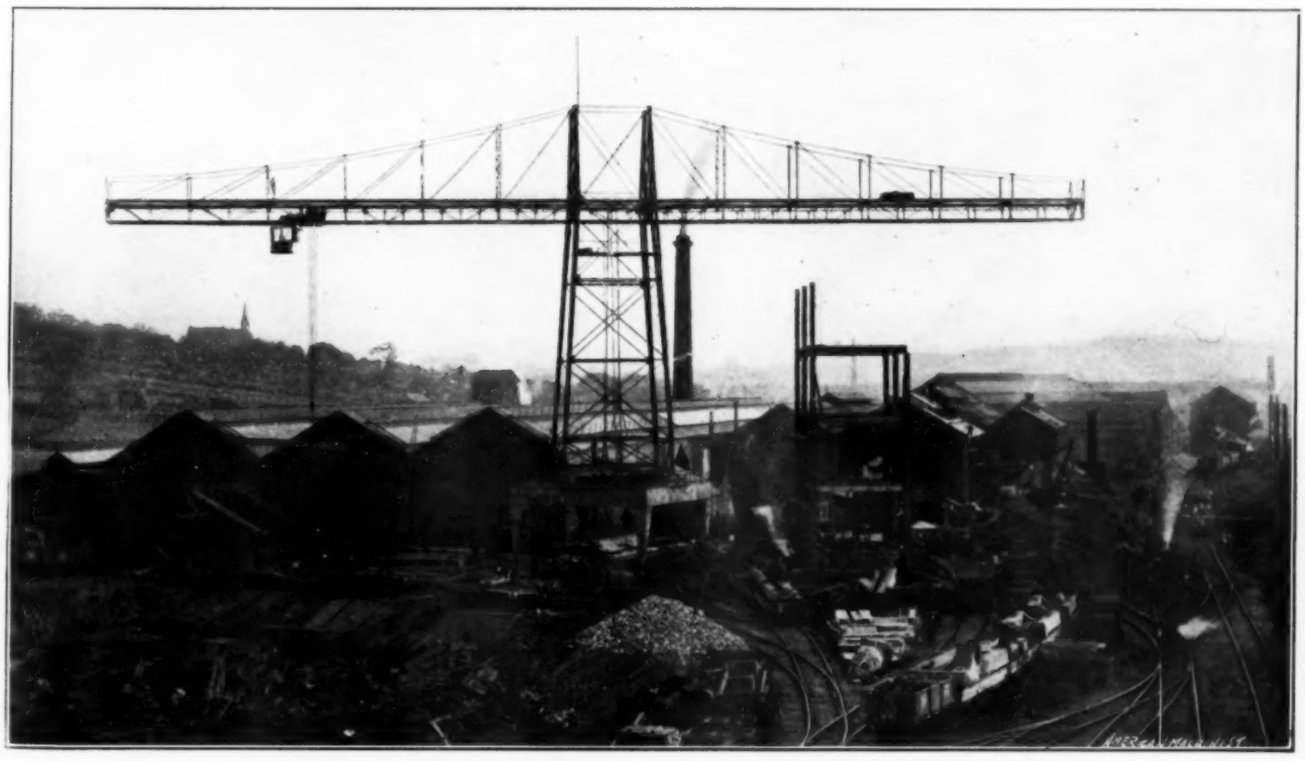


Fig. 1. Double Cantilever Crane Used to Serve Several Shops through Openings in the Roofs

of rails. Not only can castings, etc., be removed from the foundry, and so on, but the firm is enabled to erect complete pithead gears, or even towers for similar cranes, in the yard.

The Erecting Shop

The erecting shop, part of which is shown in Fig. 2, runs parallel with the main shop. The view shows winding drums and air compressors in course of building. The shop is about 350 feet long by 50 feet span, and 30 feet high to the crane girders, and is equipped with three 30-ton electric overhead travelers.

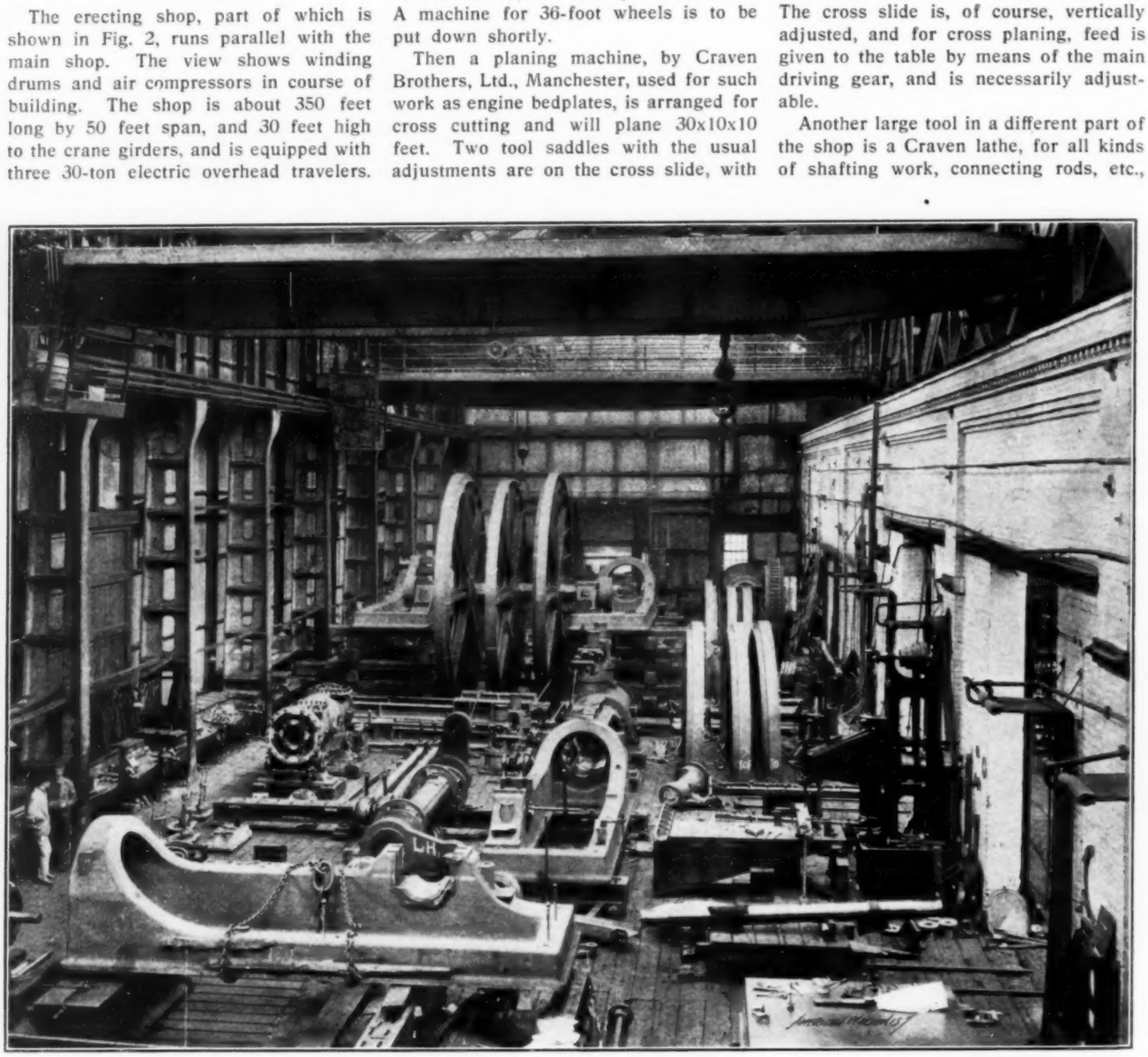


Fig. 2. Erecting Shop of Markham & Co., Ltd.
Note crane supports at the left.

Some Large Machine Tools

The machine shops themselves are in 9 bays of a shop about 340 feet long, the bays being square with the main erecting shop and each having a 25-ton overhead traveler and other crane gear to suit the machines. They are equipped with a large number of tools, many of the most modern type, and while mostly English, a number of American tools are in use, while, to cut matters short, in the girder shop are a few German machines. In the machine shops, perhaps the first tool to strike the eye of the visitor is the vertical boring and turning mill by the Niles Company, which will take in jobs 34 feet diameter up to 10 feet high. An illustration is given in Fig. 3, which shows a 25-foot winding-drum brake ring in position. This machine will take two 30-ton wheels, one on top of the other. A machine for 36-foot wheels is to be put down shortly.

Then a planing machine, by Craven Brothers, Ltd., Manchester, used for such work as engine bedplates, is arranged for cross cutting and will plane 30x10x10 feet. Two tool saddles with the usual adjustments are on the cross slide, with one on each upright. This machine has the Mitchell drive to reverse without shifting belts. A separate motor is fitted for the cross traverse. A special tool holder for big work will carry 16 tools between the two saddles on the cross slide. The table is rack driven. The bed is 45 feet long; that is, one and one-half times the maximum stroke. It has triple slides for the table, which is lubricated by rollers in oil pockets. The cross slide permits either saddle to plane the full width, and the saddles on the uprights are balanced and have an automatic vertical motion. For the cross-planing motion, an extra toolbox fits the square of one of the ordinary saddles, and motion is obtained from a self-contained countershaft on the machine to a vertical shaft, which, by bevel and spur gear, drives the upper screw in the cross slide. The cross slide is, of course, vertically adjusted, and for cross planing, feed is given to the table by means of the main driving gear, and is necessarily adjustable.

Another large tool in a different part of the shop is a Craven lathe, for all kinds of shafting work, connecting rods, etc., one of the latter being shown in position. The machine is of 30-inch centers, electrically driven by variable-speed motor. The sliding bed is 26 feet 6 inches long and will admit 22 feet 6 in. when the break is closed. The faceplate is 6 feet 6 inches diameter, and by it the lathe will admit in the gap, when open, jobs 8 feet diameter by 12 feet long. The baseplate of box section has a projection at the front, not visible in the illustration, for the pillar rest; a pillar is carried on an adjustable plate when turning work of large diameter, and carries a

slide rest, which is taken from one of the two carriages.

A Profiling Machine

No useful purpose would be served by cataloging the tools in use; almost all types are installed—modified where necessary, to suit the work in hand. For instance, a vertical milling machine was seen boring a steel connecting-rod end, the tool running dry. In one bay, a number of radial-arm drills are attached to the roof columns, and combined vertical and horizontal milling machines are included in the equipment. The profile milling machine, Fig. 5, by W. Muir & Co., Manchester, is intended to occupy in the ordinary shop much the same position as that of the universal miller in the tool room. Besides undertaking the profile-milling of objects of irregular shape, circular milling is done, as on lever ends, general milling with spiral cutters and with horizontal facing cutters for castings with vertical and horizontal faces, keyway cutting, etc. The Muir milling cutter has serrated teeth in spirals, which break up the chips, these being readily washed away by a strong stream of lubricant, which thus gets free access to the cutting edges. The spindle is 2 inches diameter, runs in gun-metal conical bearings, and is driven by a link belt, as shown.

Another tool is a double horizontal slot-drilling machine in which the two heads, with the cutter spindles opposite one another, move along a bed with a stroke up to 12 inches. The jaws for securing the job are placed at the back. All shop drawings are issued from and collected to a central box in the erecting shop, where a lad is in charge, whose duty is to keep track of them all. In the same shop is a boring mill of the firm's own manufacture. This takes cylinders of any diameter up to 100 inches.

The Tool Room and Tools

The tool room is placed on one side at about the middle of the length of the main machine shops and is equipped with the usual lathes, shapers, grinders, etc. All tool grinding for the shops is done on the Sellers machine, to standard angles. All the shops, including the foundry and the girder shop, come to the stores here for tools. The check system is used, 12 checks being allotted to each machine, or bench, and kept in the tool-room on pegs with the corresponding number. As the tools are given out the checks are taken off, one at a time, from the dozen and placed on the pegs corresponding with the position of the tools thus taken away by the workmen. The system is, of course, well known. Owing to the numerous changes, outside fitters and erectors have written tickets or paper slips, about 3 by 4 inches, torn from an ordinary order book and bearing the date, number of the article and of the man. Drills from 3/16 inch to 2½ inches diameter are stored in pigeon holes. Tools for lathes, planers and shaping machines have separate boards and drillers not only have their own boards, but have to apply at different windows. All tools bear letter references and high-speed steel is, of course, used.

A finishing tool used largely for planing, shaping and turning, has a wide surface which is at an angle of 45 degrees with the top or bottom of the shank. In end view, therefore, it is diagonal to the square section of the tool. This form can be used either right- or left-hand. The cutting edge is kept about one-half inch below the diagonal line and the material is drawn down to about half the usual thickness. About 200 of these surfacing tools, of one size and another, are stocked. Contrary to ordinary practice, parting tools are made with the cutting edge at about the level of the shank base, the material at the middle of the cutting end being, in side elevation, about 1½ times the depth of the shank. Thus, with a 1-inch tool, the depth at the center of the cutting end would be about 1½ inches.

Again, in ordinary boring heads, to produce smooth surfaces, the cutters are so arranged that no two are opposite. This is managed usually by increasing the pitch regularly round the head by ¼ inch. The cutters are placed at an angle across the head and are intended to cut with the front of the tool. They are ground to fit the slots and held by taper pins, the pin holes being sawed into from the outer diameter of the head. The slots being inclined at the base, the head is adjusted for size by pushing the cutters up the incline by means of nut and

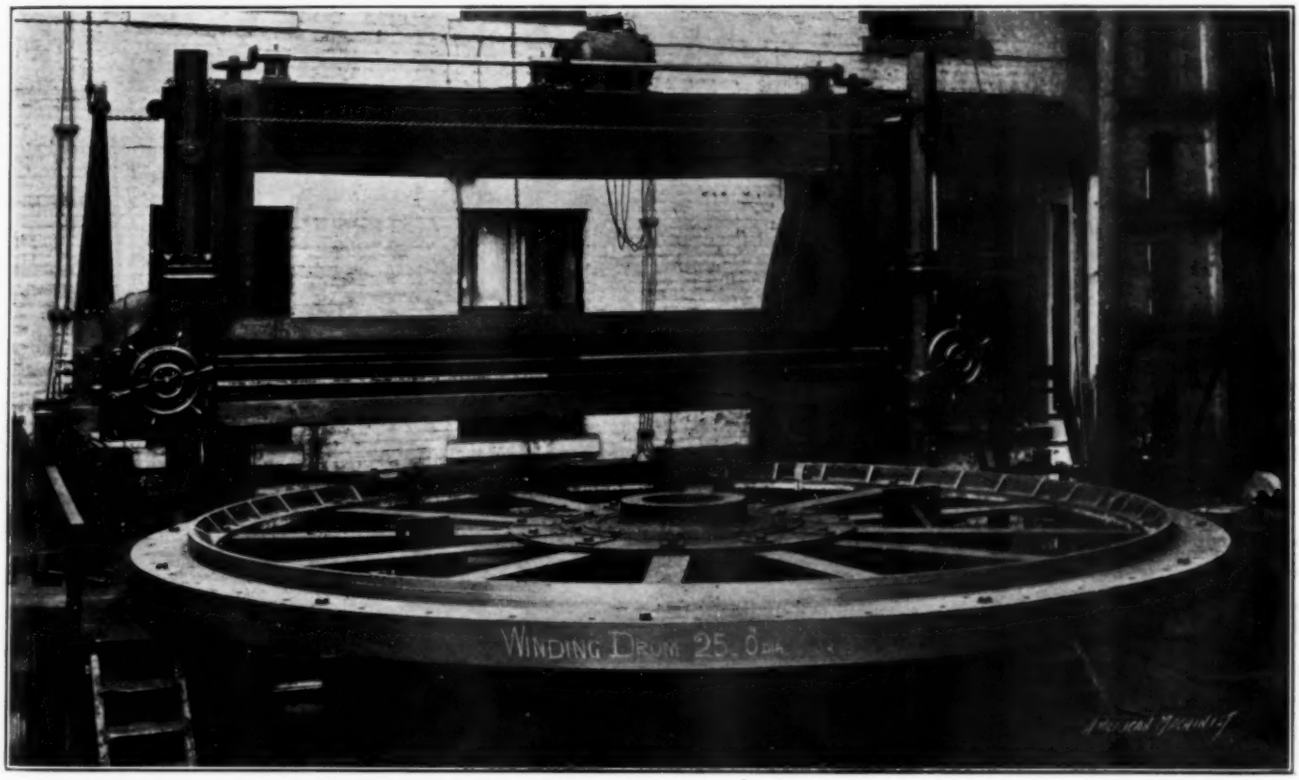


Fig. 3. Niles 34-foot Mill at Work on Winding Drum Brake Ring

washer. This type of boring head is made up to 12 inches diameter, and the change of pitch notion arose out of the purely accidental but highly successful manufacture of a reamer on the same lines. Milling cutters are built up in the same way, though here it is more difficult to see why there should be any advantage.

Rolling Journals

Another interesting feature of the practice of the firm is the use of rolling methods for closing up the "pores" and surface-hardening journals on wagon axles, etc. This is managed in the lathe by a glass-hard steel roller, which is pressed against the axle. In turning, nearly 1/32 inch is left for the reduction in diameter due to the compression. The same method is used in connection with the Herbert hexagon turret lathe and its roller steadies for turning. Here, for the same purpose, about 0.006 inch is regularly left on the diameters of pins, studs, etc.

Again, in the D-drills, used up to 8¼ inches diameter, the rubbing surfaces are formed of three strips of hardened steel let in the semi-circular part, while the cutter itself is flat and let into a slot which in plan is at an agle of 60 degrees, the cutter being secured by a central screw with a set screw at the cutter end for adjustment. At the back of the drill a hole for lubricant is bored from the shank right through to just beneath the cutter, the lubricant being thus pumped on to the tool.

Again, beside their own jigs, which are used wherever possible, the firm makes all their own gages—plug and socket, limit, snap, pin—up to 3 feet, and caliper gages up to 12 inches. These are booked out on three slates, suitably divided by scribed lines, according to the size of the gage. Snap gages are used up to four inch, plug gages up to seven inch,

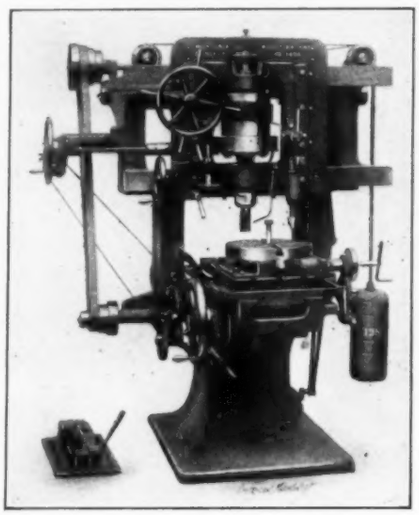


Fig. 5. Profiling Machine

and after that, caliper gages. Ordinary ring gages are found to last about four years. For instance, the last set, about to be renewed, were made at that period and were guaranteed at the time to 0.0001 inch. All gages, both plug and socket, are of steel, case-hardened. Many milling cutters also are of mild steel, case-hardened.

One of the machines in the toolroom is a Herbert sensitive drill, which will run up to 2300 revolutions a minute. With this, holes are drilled, ⅛ inch diameter by 15 inches long, with only 3/32 inch of metal on each side, the job being held simply in the vise in V-blocks.

A Gang of Twelve Radial Drills

The constructional steel shop in which bridge and girder work, roofing, etc., are undertaken, is 400 feet long, in three 45-foot bays, each with 20-ton electric traveling cranes overhead, and the necessary jib cranes. Grouting machines for Egypt for mixing cement for dam walls are built here. In this shop will be found a range of 12 radial drills, Fig. 6, by W. Asquith, Ltd., Halifax, which can be operated on either side of the center line of machines. Thus, they can easily cover a girder 100 feet long and be turned round to the other side for a similar job without waiting to remove and set the work. They are of the central-spindle thrust type, well known in Europe for similar work, one firm alone having 48 in use. They are here driven in three separate gangs, each by a 15-h.p. motor with underground shaft. The four end machines are each belted up to a cone for varying the speed if necessary, the remainder being gear-driven.

The arm is of girder type; it turns through a complete circle on a large base on ball bearings. The central pillar is, of course, cylindrical and the machine bolts to a concrete foundation. The

Fig. 4. Turning a Large Connecting Rod

FIG. 6. GANG OF 12 RADIAL DRILLS FOR STRUCTURAL STEEL WORK

spindle has a maximum radius of 5 feet 6 inches and admits a hight of 4 feet 9 inches from the level of the pillar bottom. It is balanced, has hand and variable automatic feed of 15 inches, and is of high-carbon steel, 2 inches diameter in the driving part and larger in the sleeve bearing. The feed is friction-driven. Each drill weighs about 4500 pounds.

In the girder shop is a rivet chopper, devised by C. Markham. A hammer head with a horizontal cutting edge wide enough to shear off four rivet heads at a time, is swung around its shaft and then released, to fall by gravity and thus cut off the heads. The chopper has a swing radius of about six feet and is of

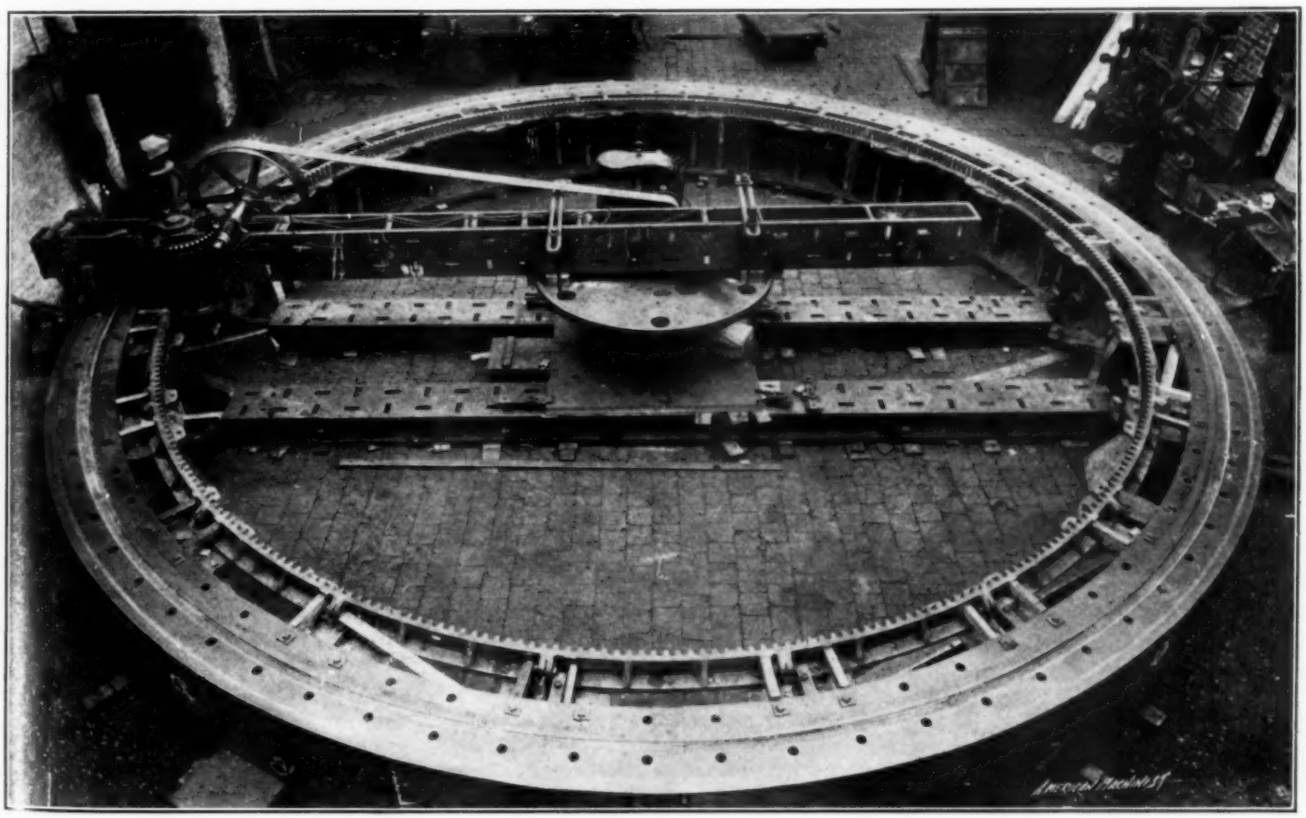


FIG. 7. MACHINING A TUNNEL SHIELD RING

nickel steel weighing 700 pounds. Two hydraulic cylinders supply the necessary power, one for adjusting the position vertically and the other for the lift preceding the cutting swing, the construction being very heavy on account of the blow. The hammer can be adjusted two feet vertically and also about two feet along a horizontal shaft by means of a screw. The work rests on lorries which are run in on rails.

The shops are electrically lighted and driven, the voltage being 110. This is, of course, low, the explanation being that the lighting plant was first put down some 18 years ago and it has not been thought advisable to change. The largest machine tools, etc., are independently driven by separate motors, but generally each bay has its own 25- or 45-h.p. machine. The works are lighted by arc lamps, with incandescent lamps over individual tools.

Turning and Machining a Tunnel Shield Ring

It has been suggested that the work undertaken is not always of the most straightforward character, and occasionally special rigs have been devised for special work. At one time, for instance, before the large vertical mill was installed, it was necessary to turn a 30-foot 8-inch shield ring from the Rotherhithe, London, S. E. tunnel. The shield itself weighs about 400 tons and there are three rings of cast-steel segments, built up after being planed, to correct radial bevel. The ring was faced across the flanges, and grooves were turned in the faces to suit wrought-steel key rings. These take the shear at the joints. The consulting engineers had suggested turned bolts to fit reamed holes, but these would have been difficult to remove. The bolt holes were, therefore, drilled clearance size and the rings used instead, and satisfactorily met the requirements.

For the machining operation, Fig. 7, a turn table was bolted on two girders on the floor and carried on top an electric motor, which revolved with the table. On the latter also was clamped a girder forming an arm which at the outer end supported a head with worm gear, this being belt-driven from the motor, and in turn, drove a pinion below, gearing with a circular internal rack which was temporarily bolted inside the job. The tool-holder was mounted on the arm and a couple of magnet rollers, one on each side, held the tool down to the face so that it could not spring when cutting. This device was arranged by Mr. Markham, and the only thing specially made was the circular rack. The job was in every way a success.

Back Gearing for Lathes

By Entropy

The principles of designing lathe cone steps, and double back gear ratios to give suitable speed changes without duplication. Examples worked out, fully explaining the method for four-step and three-step cones, and speed ratios of 16 to 1 and 4 to 1.

The single back-gear drives seem to be pretty well understood and the majority of lathes now on the market have a fairly regular progression of speeds. A perusal of engine-lathe catalogs will show, however, that in the case of "double back-geared" or "triple-geared" lathes there is usually an overlapping of speeds. For example there is a 38-inch lathe on the market the back-gear ratios of which are 13 to 1 and 40 to 1. This lathe is also built as a single back-geared lathe with ratio of 13 to 1. Necessarily, with the triple gearing in mesh, three of the five slowest speeds overlap those obtained by the use of the single gears.

If we let n equal the percentage of increase of each successive speed of the lathe, beginning with 1 revolution per minute as the slowest speed and write down a table of speeds we get:

	Revolutions per Minute.
Slowest speed	1
Second speed	$1(n+1)$
Third speed	$1(n+1)^2$
Fourth speed	$1(n+1)^3$
Fifth speed	$1(n+1)^4$
Sixth speed	$1(n+1)^5$
Seventh speed	$1(n+1)^6$
Eighth speed	$1(n+1)^7$
Ninth speed	$1(n+1)^8$
Tenth speed	$1(n+1)^9$
Eleventh speed	$1(n+1)^{10}$
Twelfth speed	$1(n+1)^{11}$

If this lathe is to have a four-step cone and be double or triple geared (both meaning the same thing in result), then the 1st, 5th and 9th speeds will have the belt on the same step of the cone pulley and the ratios between the back gears must be in the ratio of these speeds, viz; 4 to 1 and 16 to 1, or other ratios such that one is the square of the other, as 16 is the square of 4. If there are three steps only, then the same rule applies; the 7th speed is the square of the 4th and the second gears must have a ratio equal to the square of the first.

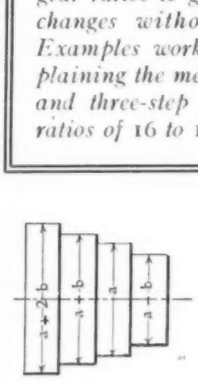


Fig. 1

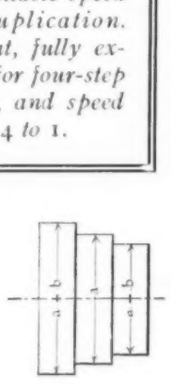


Fig. 2

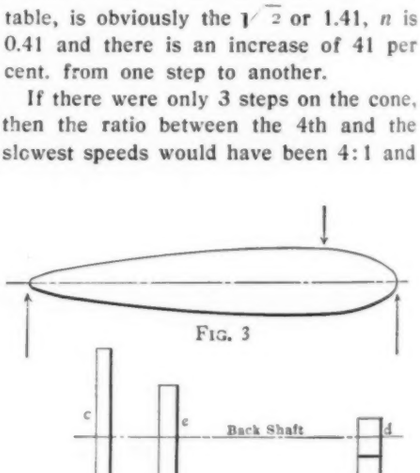


Fig. 3

Fig. 4

Cone Steps and Gears for Double Back-geared Lathe

With a pre-determined ratio of back gearing and a definite number of cone steps, the process of getting at the ratio between consecutive speeds is simple. Take for example a triple-gear ratio of 16:1; then the single back-gear ratio must be 4 to 1, whether the cone has 3 steps or any other number. If there are four steps, then the 5th speed and the slowest speed are in a ratio of 4:1; the back-gear ratio. The 3d speed is the square root of the 5th ($[n+1]^2$ and $[n+1]^4$), so the 3d is 2 when the slowest is 1. The second then, from the table, is obviously the $\sqrt{2}$ or 1.41, n is 0.41 and there is an increase of 41 per cent. from one step to another.

If there were only 3 steps on the cone, then the ratio between the 4th and the slowest speeds would have been 4:1 and the second speed would have been, by the table, $\sqrt[3]{4}$ or 1.59 and n would be 0.59.

It is the usual custom to design cone pulleys with the same variation in size between each of the successive steps. This is not exact either as to constancy of belt length or uniformity of variation

in speed, but it has been proved near enough for all practical purposes. It is also good practice to make the cone pulleys such that the small step of the counter cone is the same size as the next to the smallest step on the head cone. See Fig. 1. If in this case with a four-step cone we let the diameter of the two equal steps be represented by a and the difference in diameter by b, then the ratio of counter speed to head cone speed will be unity (1) when the belt is on the equal steps. When it is on the steps next, to the left, the ratio will be $\frac{a+b}{a-b}$. The speed ratio between the two steps we found above to be 1.41 to 1. Therefore we have the proportion

$$\frac{a+b}{a-b} : 1 :: 1.41 : 1.$$

In designing a headstock we usually determine on the size of the large step of the head cone which we will call 12 inches or $a+b=12$ inches. $a-b$ then will be $12''-2b$ and we have

$$\frac{12}{12-2b} = 1.41 \text{ or}$$

$b = 1.75$ inches, which is the difference between diameters of steps.

Having decided on 12 inches for the large step, the others then are 10¼, 8½ an 6¾ inches. Counter cone is 13¾, 12, 10¼ and 8½ inches. If the counter speed is 100, the head-cone speeds are 70⅔, 100, 140⅔ and 204, which is near enough to the geometrical progression of 1.41 to 1 previously figured.

In the case of a three-step cone, the layout would be as in Fig. 2, a again being the largest step of the head cone and b the difference in diameters.

Taking the ratio between the two right-hand steps as being the simplest, we get, from the figures already obtained for three-step cone:

$$\frac{a}{a-b} : \frac{a-b}{a} :: 1.59 : 1.$$

With $a = 12$ inches, we get

$$b = 2\tfrac{1}{2} \text{ inches.}$$

and the head-cone steps are 12, 9½ and 7 inches. Counter-cone steps, 14½, 12 and 9½ inches. The head-cone speeds with the counter running 100 revolutions per minute are 79 1/6, 126⅓ and 207 1/7. The ratio between the first two is 1.59:1 and the second two, 1.64:1, while to be exact, both should be 1.59:1. This little variation is not noticeable when we consider how variable a belt transmission is in any case.

After determining on the number of steps, size of cones and gear ratios, it is necessary to get at the actual gear diameters to be used. The size of the face gear is usually only a little, if any, larger than the diameter of the large step of the head cone. The diameter of the cone gear must be such as to allow of a reasonable sized spindle so as to keep the rear bearing large enough. By the way, I might say that the rear bearing on most lathes is larger than I believe to be necessary. A lathe spindle is really a beam of circular cross section overhanging one bearing, but supported by two; see Fig. 3. The direction of the forces depends upon whether the work is heavier than the upward pressure of the cut or not. The theoretical form of this beam, to secure the greatest strength for the least metal, is a hyperboloid, as shown in Fig. 3. It will be seen that the length of the front bearing and the size of the rear, are things of little comparative importance, the important thing being the diameter of the front bearing and the distance between bearings, making the latter as large as possible relative to the overhang of the spindle.

In our case, considering the four-step cone design, we will assume a face gear 12½ inches pitch diameter and a cone pinion 3½ inches, which allows a 2½-inch rear bearing. Referring to Fig. 4, we see that for the largest ratio of back gears (16 to 1) we will have

$$\frac{12\frac{1}{2}}{d} \times \frac{c}{3\frac{1}{2}} = 16,$$

the accepted back-gear ratio, and also

$$c + 3\tfrac{1}{2} = d + 12\tfrac{1}{2}$$

since the center distances must be alike.

Solving accurately, we get $d = 2.58$ inches pitch diameter. This would be most nearly correct, for an 18-tooth gear 7 P. or 2.57 inches pitch diameter, but the 12½-inch gear, with which we started, could not be cut 7 P. It could be cut either 6 or 8; however, 6 would be the nearest. If we take 6 P., the gear d would be 2½ inches pitch diameter and c, 11½ inches, the gear ratio being

$$\frac{12\frac{1}{2}}{2\frac{1}{2}} \times \frac{11\frac{1}{2}}{3\frac{1}{2}} = 16\tfrac{3}{7} : 1.$$

To get the ratio more exactly, we may try again, keeping the 12½-inch face gear and the 2½-inch quill pinion.

$$\frac{12\frac{1}{2}}{2\frac{1}{2}} \times \frac{c}{g} = 16 \text{ and}$$

$$c + g = 15$$

Solving $c = 11\ 3/7$

$$g = 3\ 4/7$$

which can be cut 7 P. and gives accurate results.

To get the 4:1 ratio of the back gears, we have in the same way

$$\frac{12\frac{1}{2}}{2\frac{1}{2}} \times \frac{e}{f} = 4$$

and $e + f = 15$.

Then $e = 6\frac{2}{3}$ inches and $f = 8\frac{1}{3}$ inches, which can be cut 6 P. It is customary to make the gears c, g, e and f all of one pitch, but there is no objection to making them different, especially as it is usually necessary to do so in order to get quite near the speed ratios desired.

The curious result is that gear f is larger than e, but this will be found to be the case on any lathe, if it is designed right and if gear g is larger than d. Gear g is almost invariably larger, on account of structural necessity. If both gears g and d can be made the same size, the whole matter is simplified, as all that is necessary is to make the ratio between h and d and c and g, each equal to the first gear ratio and then make e and f of equal size. To do this will usually mean a larger back gear than would be otherwise needed and no advantage is gained.

I venture to say in conclusion that if more lathes had been designed in the past with carefully thought out cones and gears, the geared head would not have had the vogue that it now has.

Tool Grinding Facilities

Shop owners do not always fully realize the cost of tool grinding where it is done individually. A case in point is a certain pattern room—it cannot be called a shop—which is connected with a manufacturing concern which puts out a line of well known machines. In the pattern room is a 24-inch grindstone which is arranged to be operated by foot power, the man who wishes to grind a tool very badly, finding a rather precarious seat on a little three-cornered arrangement which is attached about like a bicycle seat, to the frame of the grindstone.

There is no comfort for the man when he is thus perched adjacent to the stone, and the pumping motion of both feet is by no means conducive to accuracy in tool grinding. In addition to all this, it is impossible for the operator to change his position to see the condition of a tool, or to hold it at the proper angle. The result is as follows:

There is not a well sharpened tool in that pattern-room. Every chisel and plane bit is ground at an angle for working brass rather than soft wood. The wood turning-lathe tools were all simply impossible. The patternmaker is prone to scrape wood anyway, when he gets it in a lathe, and it is certain that these tools would act in no other way.

The effect is felt in every pattern turned out in that room. The men are spending much time whetting planes and chisels, trying to make them cut decently; more time is spent in making poorly sharpened tools cut at all, and the operations of accuracy, so necessary in the pattern shop, are made much more tedious and more uncertain. When a rush job is brought in, it is always necessary for the patternmakers to stop and try to put tools into condition before they can even attempt the work. It is safe to estimate that the lack of proper grinding facilities costs the owners at least $150 per man per year.

Why Gear Hobbing Machines Cut Flats

By Geo. B. Grant*

A demonstration of the difficulties encountered in the use of the hob for generating spur and spiral gear teeth, showing that the difficulties are of a theoretical as well as of a practical nature.

*President and mechanical engineer, Philadelphia Gear Works.

What and why are the "flats" sometimes very evident on the working face of a gear tooth that has been cut on one of the hobbing-gear cutting machines that are now being industriously advertised and circularized by many makers?

The hobbing-gear cutting machine has various defects as well as "perfects." You can find all the latter thoroughly shown up in the circulars of the makers of the machines, but you can hunt for the former until you go blind and never discover them until you have bought a machine and have it at work. Then you will begin to see things.

One of the things you will see is the "flat."

In my Fig. 1 I have indicated the nature of the flat. The surface of the tooth is made up of narrow facets or flat spaces running the whole length of the tooth, each flat being separated from the next by a ridge. Sometimes these flat places and ridges will be very evident and at other times not noticeable, but they are always there; sure as mathematics! Let us study the matter a bit and find out when they will show and when not. What conditions cultivate them and what discourage them.

The gross ignorance on this subject, indicates that very little has been published on it. Perhaps this is the first attempt to explain the phenomenon. It is the first so far as I know. One workman told me that the flats were part of the order, made "a purpose." I was polite enough to choke off a laugh. The manufacturers are perfectly willing to cut sample gears for a prospective customer, and said samples will be flatless. How do they do it? I think I know.

I used to say that there were tricks in all trades except the gear trade, but now, on further consideration I am forced to admit that a few have crept in recently from outside.

In Fig. 2 I show a greatly exaggerated example, gear tooth with only three flats on the side. The first hob tooth H^1 comes to the center of the tooth space and takes off stock, leaving the first flat, F^1. Soon, the second hob tooth H^2 reaches the center and forms the second flat F^2. Next, the third hob tooth H^3 comes along and forms the third flat F^3, and so on as long as the cutter is in the stock. While each hob tooth is passing beyond, and before the next one arrives at the center of the tooth, the gear blank turns a little so that the flats are at an angle with each other. The result is the three flats in the finished surface, with ridges x, y or z between each flat and the next one.

In the resulting tooth surface there is but one line in its true place. The pitch line b is right, the lines a and c are approximately correct, while the ridges x, y and z are much out of place. The true curve G, except at the one line b, is wholly inside the resulting tooth.

It must be stated here, despite the claims that the hobbing process is theoretically perfect, that such a thing as a theoretically true hobbed tooth is an utter impossibility. If the machine is perfect, and the cutter ditto, both impossible conditions, the resulting teeth are merely close approximations. If they are true along the pitch line they are too full everywhere else. The reason of this is plain. The hob tooth reaches the true surface of the tooth it is cutting only when it reaches the center of the tooth space, and it can thus center only when it is at

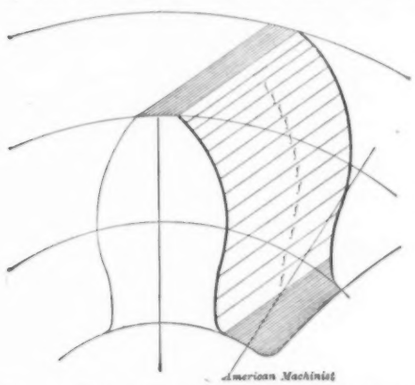


FIG. 1. FLATS PRODUCED BY THE HOBBING PROCESS

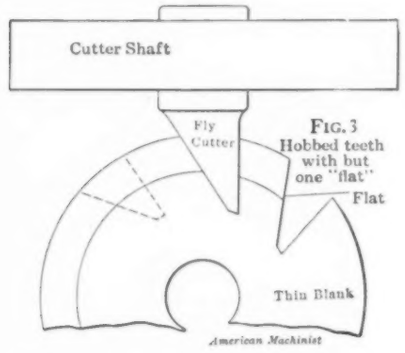


FIG. 3. EFFECT PRODUCED BY A SINGLE CUTTER

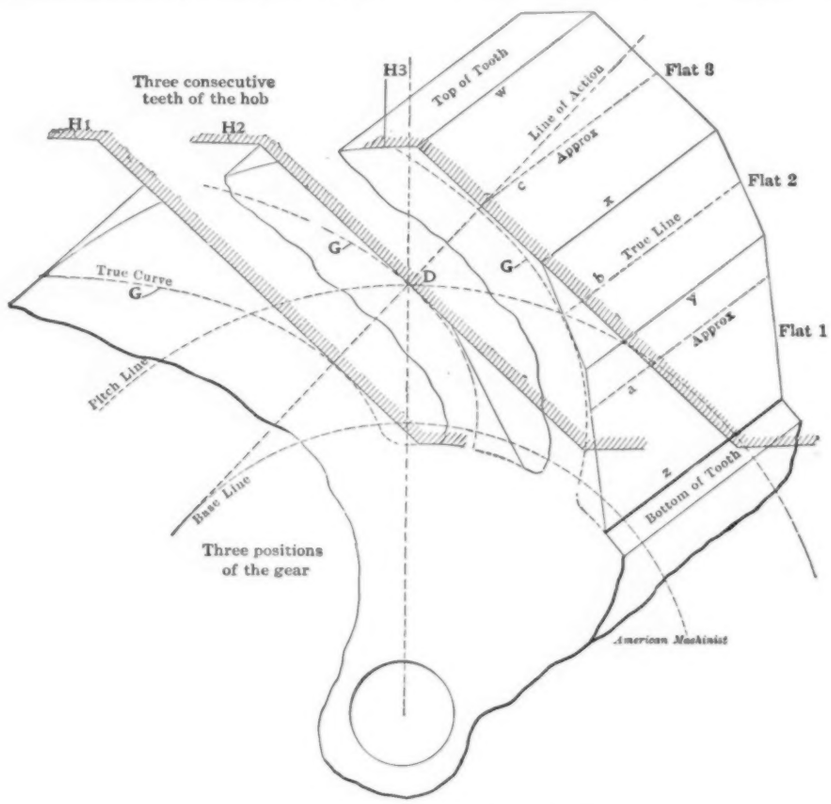


FIG. 2. FLATS ON HOBBED SPUR GEAR

the common center line, the line that is normal to both the axis of the gear and to the axis of the hob.

Take two cylinders, call one the gear blank and the other the hob, and see if you can get them to touch each other, when not parallel, in more than one point, and that point on the common normal to both axes. The same law governs right through the work.

The approximation, when the work is well done, is very close, quite close enough for business purposes, and generally quite as close as can be kept up to in the practical application of the mechanical process. But the makers of the machines are advertising that the hobbing process is theoretically perfect, while that of the ordinary rotary cutter is an approximation at best, therefore the old way passes and the new way takes its place. This statement is not true. The hobbed gear tooth is an approximation quite as much as the ordinary single-cut tooth is an approximation.

With this difference, that by taking infinite pains you can make an ordinary Brown & Sharpe form of single cutter do its work with a degree of approximation that is as great as the pains taken, for its error is wholly practical, while the error of the hobbing process is theoretical and not to be overcome. The theoretically perfect hobbed tooth does not exist, while the theoretically perfect single-milled tooth is a real, although perhaps an unattainable fact.

Now, what causes the "flat?" Clearly it is due to the fact that the centering action of the hob is intermittent. The first tooth of the hob finishes its cut only as it comes to the center position, and then passes on to cut away waste stock. There is an interval of time, then, before the second hob tooth centers, and another interval before the third hob tooth makes a record, and so on to the end. During each of these intervals of time the gear blank moves over a little so that the next record is not continuous with the last one. The result is that the tooth outline left by the hob is a series of short straight lines, and, as the hob is fed across the face of the gear, it leaves the flats and ridges.

To get a good idea of the nature of the flat consider Fig. 3, which shows a still more exaggerated case, that of a gear cut with a hob having but one cutting tooth. The resulting gear has but one flat. To simplify the problem assume the gear blank as a thin disk. The fly cutter, having but one cutting edge, chops out one chip, of its own shape, every time it passes the line of centers, and that shape has but one straight tooth face, the flat. If there is another fly cutter on the other side of the shaft and set further along on it, as shown by the dotted line, it will get down to the blank in time to cut off the corner of the tooth face and make a second flat.

To avoid or reduce the flat, then, make the hob teeth as near together as practicable. Theoretically, the flat will be made unless the hob cuts with its entire surface, as if the surface was file-cut, with multitudes of fine teeth, I can imagine a hob made of emery that would make flatless teeth. A hob of the "bur" form, with teeth very close together, such as the single cutters that were used before the Brown & Sharpe cutter was invented, would make a practically flatless cut, but the ordinary form of hob, with "backed off" teeth, and the only kind of hob that can be sharpened when it is dull, will not make a cut without flats. If the cutting teeth are very far apart and on a cutter of small diameter, the flats will be very prominent.

But the flat is not the only defect of the hobbing process. There are others.

A Thread Clearance Gage for Screws

By S. Baltzer

Construction and details of an instrument for measuring the thread tolerance of screws, and by the use of which the diameter of the tested screw can be found directly.

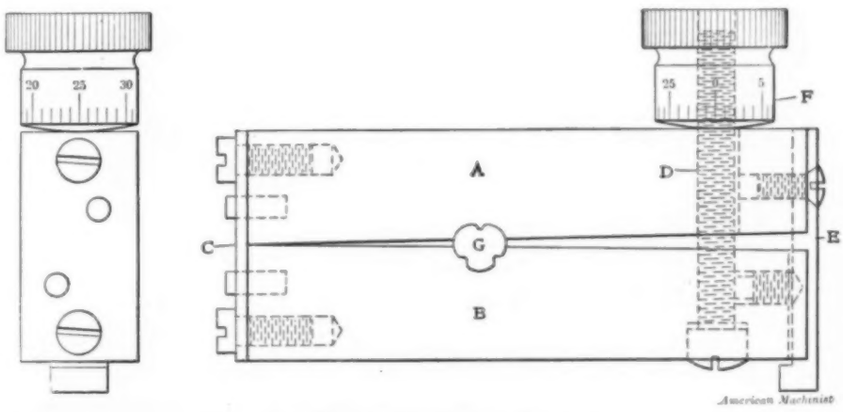
The Société anonyme ateliers Barriquand & Marre, at Paris, has brought out a thread-tolerance gage for screws, which is illustrated herewith. This gage consists mainly of two jaws, *A* and *B*, which are connected at one end by a hinge *C*, and at the other by a screw *D*, on which is fitted a graduated nut.

The member *C*, which connects the two jaws, is made in the form of a flat spring, which is fastened to the jaws by means of two screws and two dowel pins. To prevent side movement of either of the jaws when opening and closing, guide *E* is provided which is fastened to the jaw *A* by a screw and slides in a slot of the lower jaw *B*, as the latter closes. This guide is provided with a head, which limits the opening of the jaws.

In the two jaws is formed the threaded opening whose maximum diameter exists when the jaws are pressed farthest apart, agreeing with the coincidence of the zero on the micrometer scale and the reference mark on jaw *A*. If now the two jaws be closed by nut *F*, the micrometer readings will show the amount of movement. The minimum is reached when the two touch. Thus we can make the two limiting positions afforded by the full opening and closing of the instrument correspond to the maximum and minimum allowances for a screw.

All screws of a certain diameter are first tested in the wide open instrument; those which fail to enter the opening are laid aside without further consideration. For the screws which enter there are two possible cases: 1. The jaws *A* and *B* touch the circumference of the screw before the gage is completely closed. In that case the screw is accepted. 2. The gage closes before it touches the periphery of the screw, in which case the screw must be considered inaccurate.

With the aid of the graduation on the circumference of micrometer nut *F*, which is calculated with reference to the lever arm from the hinge *C* to the opening *G* and to the screw *D*, the diameter of the tested screw may be found directly. This proves a time-saving element when quantities are handled.



THREAD TOLERANCE GAGE

Making an Adding Machine

Editorial Correspondence

All parts being interchangeable, many accurate machine operations must be performed. A large number of special steel drop-forged parts are used to obtain good wearing qualities and strength.

The cams are cut in lathe with large master cams. Internal teeth are cut on a shaper with special attachments. Many accurate milling operations are performed. Numerous holes are machined with one setting of the pieces in box jigs. Complicated punching and bending operations are performed in punch presses.

The adding machine that is shown in Fig. 1, is built by the Comptograph Company, of Chicago, Ill. A large number of its parts are made of drop forgings and hence it has been nick-named the "drop-forged adding machine." The case, as will be seen, is made of pressed sheet steel in several parts, and some interesting operations in pressing and drawing the case are encountered.

The more important drop-forged parts that are used in this machine are shown in Fig. 2. Most of these pieces are straddle milled, then put in drill jigs, and drilled, reamed and counterbored complete in one setting.

Cutting Cams

The double cam *A* is turned on an engine lathe as shown in Fig. 6. A master cam that is four or five times the diameter of the finished cam is screwed to the spindle of the lathes in place of the face plate. The screw is removed from the slide and a weight attached to it that pulls the slide, with the turning tool, against the cam. A roller that follows the master cam is attached to the back end of the slide. The master cam is made of two plates each of which is given the correct shape for its particular cam and the roller following these causes the double cam, or two cams, to be turned on the forging that is shown in front of the master cam.

Cam *B*, Fig. 2, is also cut on this fixture by the use of another master cam. A round-nosed tool is used in the tool holder and the lathe spindle is arranged to run at a very low speed.

Cutting Internal Teeth

The internal teeth on steel forging *C*, Fig. 2, are cut with a special fixture mounted on a shaper. The general principle on which this works is plainly shown in Fig. 4. A special head with a finished piece clamped into position is fastened to the shaper ram. The oscillating chip extractor *F*, located in this head, is moved forward and back by a grooved cam that is bolted to the frame of the machine.

The cutter *D*, is held in the swinging arm *I*, which is driven by the worm and worm gear at the right of the machine. The shaper feeding rod is attached to a ratchet-fed pawl *J*, that is fastened on the end of the worm shaft. This moves the swinging arm *I*, which revolves the cutter *D* enough to take a good chip every time the ram goes back.

The cutter is free to revolve and is meshed with the sector *E*. In this way the hardened spur-gear cutter is turned to new cutting teeth every time the ram moves forward. The cutter rolling over when the arm *I* swings, all of its teeth are used in cutting the internal on forging *C*, and a good job is the result.

Milling Jobs

In Fig. 5, the pieces shown at *K* are clamped, 10 at a time, in the special vise jaw with spring pressure levers. They are then milled with the gang of form cutters as shown. This leaves practically no bur, and very little finishing work is given the pieces after milling.

The milling of the hammer-frame casting, as shown in Fig. 3, is a very complicated job, owing to its being located in the same jig 25 different times for as many cuts. Each cut must be accurately machined and in perfect relationship with all the different cuts.

Six sliding dowels are used while locating it and its lateral position in the jig is obtained from a fixed point by a special indicator that reads in thousandths. The jig is constructed so it can be used in four different positions. A special clamping device is used to clamp the frame after it has been located.

Drilling Jigs

The castings for the electric drive frame and its cover are shown at *L* and *M* in Fig. 7. At *N* and *O* are shown the box jigs in which these pieces are drilled, counterbored, reamed and tapped. Some

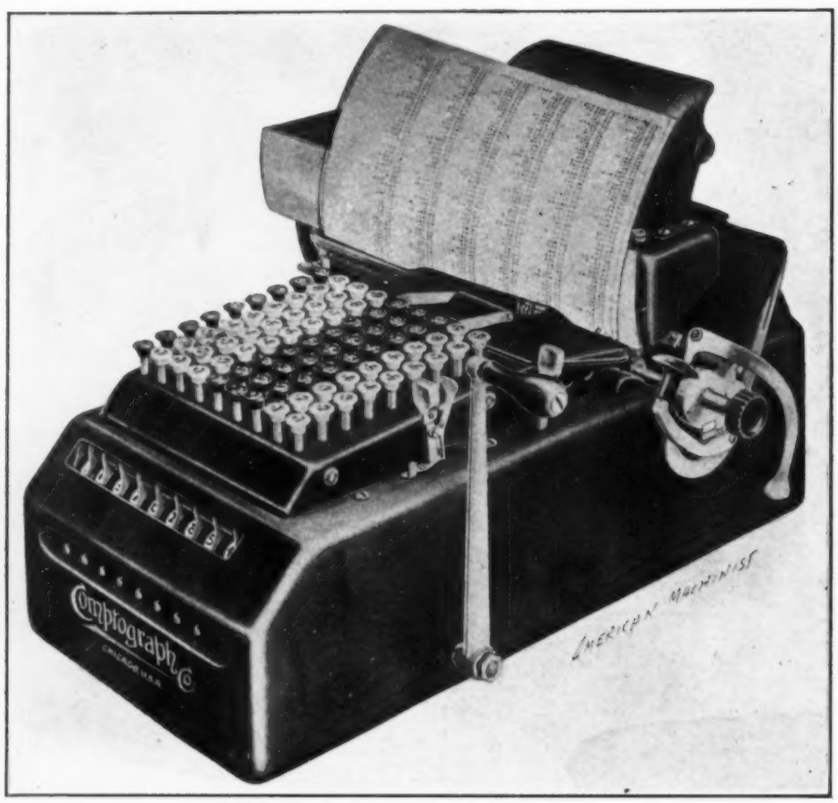


Fig. 1. The Completed Adding Machine of the Comptograph Company

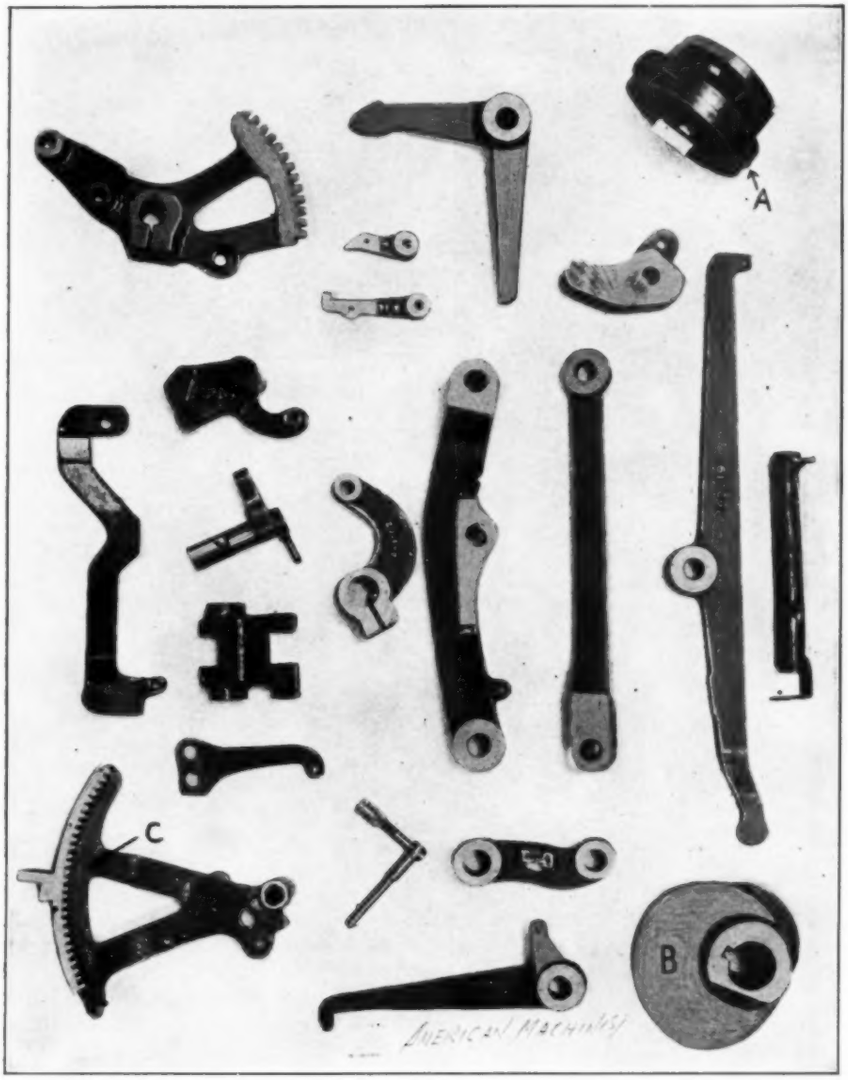


FIG. 2. DROP FORGING USED IN COMPTOGRAPH

of the holes are put through at an angle and then the piece shown at *P* is used to rest the box jig on.

There are 38 holes in the frame *L* and each one of the tools in block *Q* is used in machining these various holes. All of the 38 holes are drilled, counterbored, reamed or tapped, or two or more operations are performed on one hole with one setting in the jig.

The cover *M* does not have as many holes as the case, but each one of the tools shown in the block *R* is used in machining these holes and they are likewise all machined with one setting in the jig.

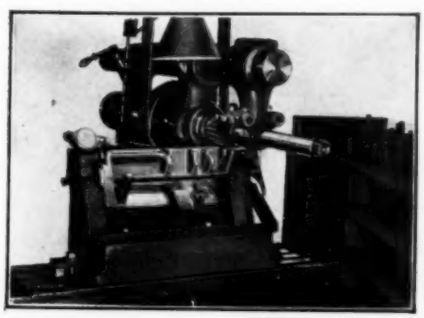


FIG. 3. MILLING HAMMER FRAME CASTING IN JIG

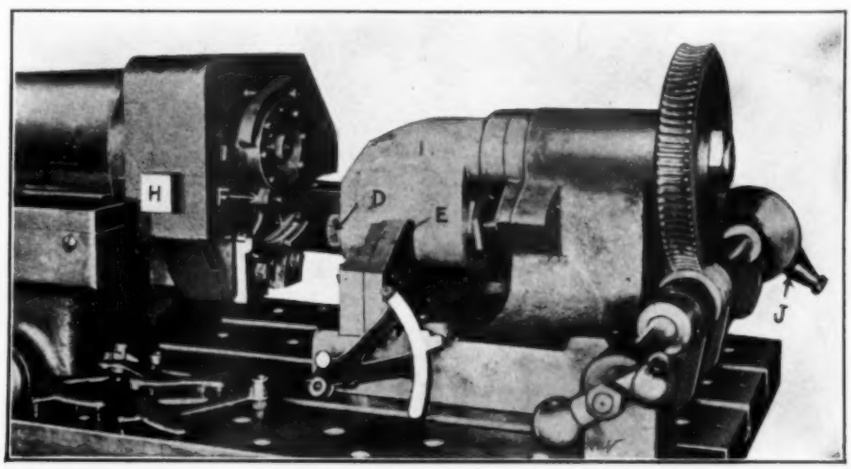


FIG. 4. SHAPING INTERNAL TEETH ON FORGING C

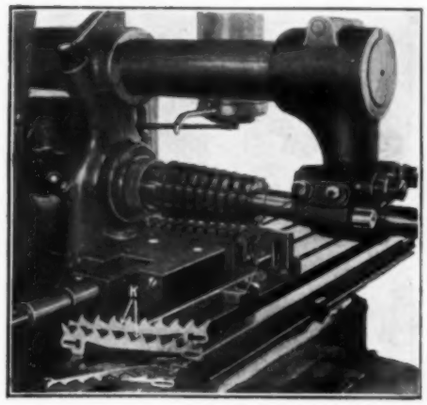


FIG. 5. GANG MILLING

SMALLEST PIECE

The smallest sheet-metal piece that is made is shown at *J* in Fig. 8. It is made of crucible steel, 0.065 inch thick and about ¼ inch long. To make this interchangeable like all the other parts of the comptograph, requires special tools and gages shown in Fig. 8.

It is first blanked out in the blanking die *C*, then trimmed in the trimming die *A*, and burnished in die *C*. Both the trimming and burnishing dies have swinging gages, as shown at *I*, to enable the operator to accurately and quickly locate the piece on the die.

After shaping the piece is put in the hinge jig *D*, to be drilled, reamed and counterbored. The depth of the counterbore must be very accurate and for that reason dial gage *E* is used for measuring this depth. Gage *F* measures the length and gages *G* and *H* measure other points which must bear a proper relation to the hole. Each gage has a master piece attached to it to enable the inspector to test them occasionally.

KEYBOARD SHELL

The keyboard shell shown in Fig. 9 is drawn out of 1/16-inch stock and the ⅛-inch square holes for the keys are after-

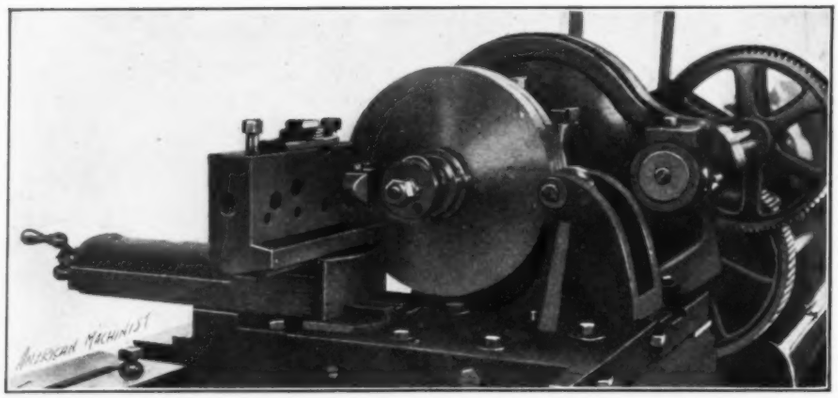


FIG. 6. TURNING CAMS WITH A MASTER

ward punched in it. These holes are not square with the top surface, but are at an angle of 18 degrees. One row of ten holes is punched at a time. The punch and die for doing this work are shown at *K* and *L*.

The shell is clamped to the frame *M*, and this is moved along to the different index holes *N* to properly locate the rows of holes. The method of guiding the punch is clearly shown and it will be recognized that to punch ⅛-inch holes in 1/16-inch stock at an angle of 18 degrees requires an accurately guided punch.

BENDING AND GAGING

The ribbon reverse piece shown in Fig. 10 is one of the most irregular shaped pieces used in the machine. The upper view of it shows the blank as it is punched out, below that on the left is shown the piece after passing through

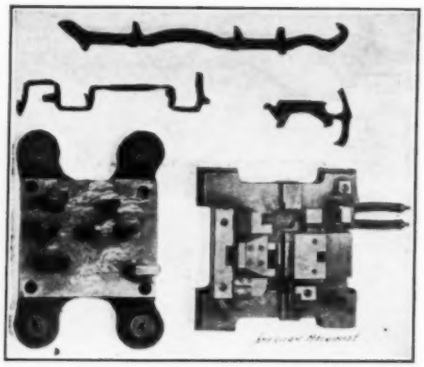


FIG. 10. FORMING DIE FOR PIECE SHOWN

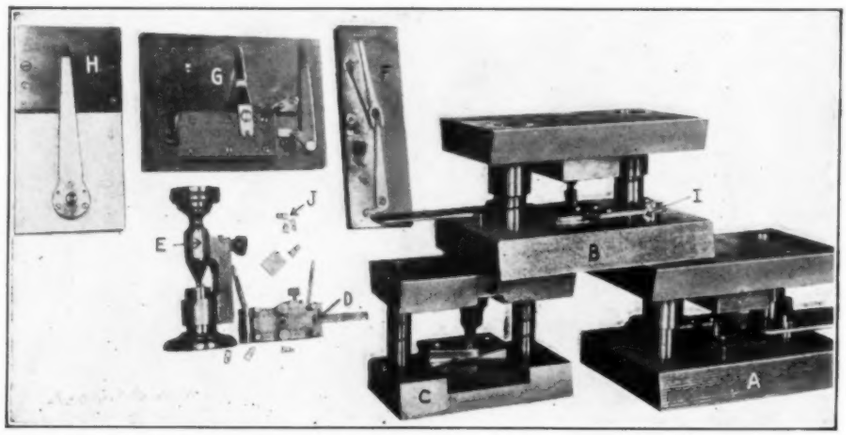


FIG. 8. TOOLS AND GAGES USED FOR MAKING ONE SHEET-STEEL PIECE

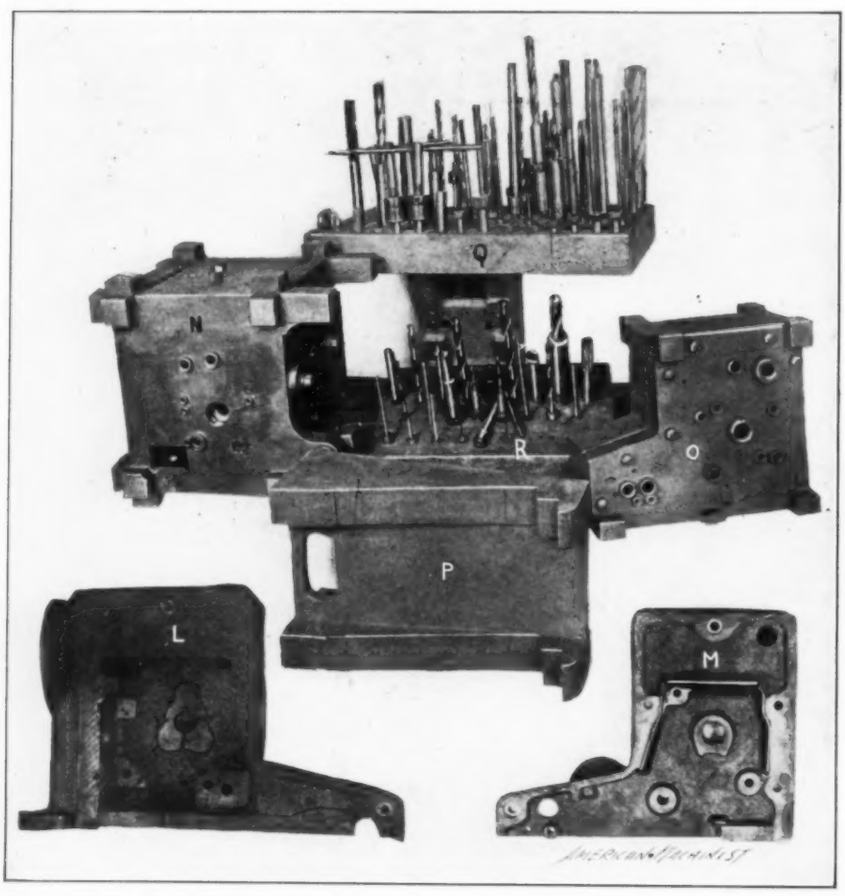


FIG. 7. JIGS AND TOOLS USED TO MACHINE HOLES ON ELECTRIC DRIVE FRAME CASTING

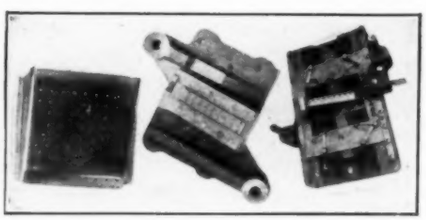


FIG. 9. KEYBOARD SHELL PUNCH AND DIE FOR HOLES

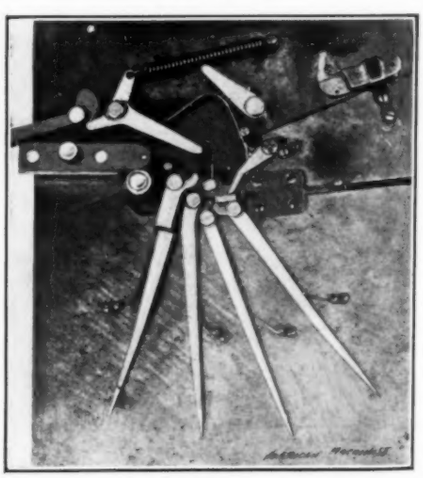


FIG. 11. GAGE FOR RIBBON REVERSE PIECE

its first bending operation and to the right of this is the finished piece. This is completely formed with one stroke of the press by using the punch and die shown below the piece.

Many kinds of special gages are used for testing the different pieces that enter into the construction of this machine and a sample of these is shown in Fig. 11. This is the gage for testing the ribbon reverse piece after it leaves the punch press.

On it there are nine points that must be exactly to size. The spring lever operated by the cam lever, at the upper left-hand side of the halftone, insures a uniform pressure against the piece while being gaged. The four pointers at the bottom must point exactly to the line scratched on the plate when the piece is in position. The other five points are gaged by the levers shown above these.

Like all the rest of the gages, a master piece is attached to it so that the gage can be tested at any time. This may be seen held by the strap in the upper right-hand corner.

What is claimed to be a record in shaft sinking was recently accomplished on a siphon of the New York City aqueduct, where a shaft 16⅔ feet in diameter was sunk 177 feet in thiry-one days, the shaft running through hard shale.

Examples of Engine Lathe Work

Editorial Correspondence

The illustrations show some interesting examples of engine-lathe work which was done recently on a Lodge & Shipley lathe equipped with multiple stops on both the longitudinal and cross feeds as well as a turret tailstock.

Fig. 1 shows the tools and fixtures used in handling a small eccentric and eccentric strap for steam-engine work. Beginning with the rough casting at *A* the hole is first bored and reamed, then mounted on the front end of the expanding mandrel *C*, which has a taper shank fitting the lathe spindle. The expanding plug is easily adjusted to hold the work firmly for turning the outside of the eccentric, which is shown finished at *C*. Boring bars *D* and *E* and reamer *F* are the tools used for finishing the hole, while the smaller tools above are used in connection with the eccentric strap shown at *G*.

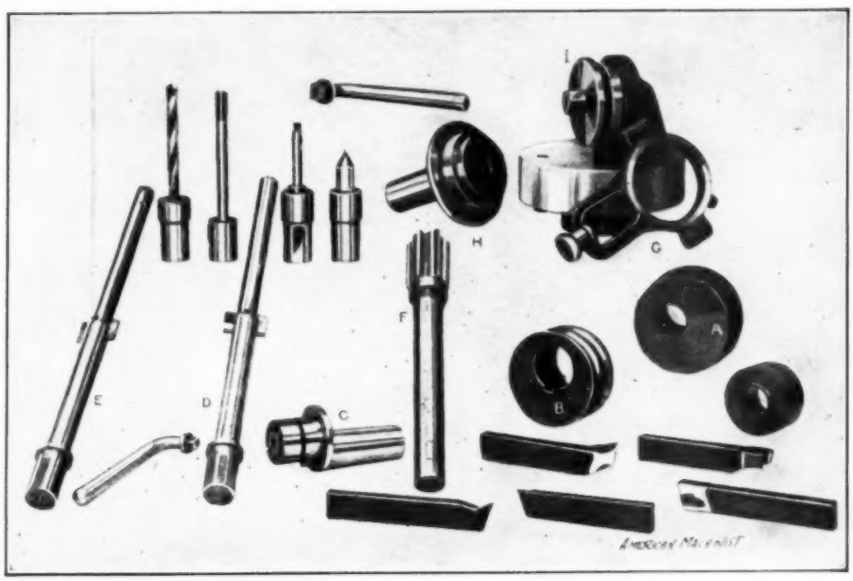


FIG. 1. MAKING ECCENTRICS AND STRAPS

The eccentric strap is first bored in the usual way, is then held on the expanding chuck *H* while the other side is faced true with the bore. It is then mounted by the bore on the special fixture *I*, being held in place by the *C* washer shown. This holds the eccentric bore in exact alinement so that the hole for the eccentric rod can be bored in the end. This method allows the eccentric-rod hole to be bored exactly in line with the eccentric bore and makes an exceedingly efficient outfit for this work.

PISTON RINGS

Fig. 2 shows a chuck and tool equipment for boring and turning the piston ring. The rings are cast in the pot shown at *A* and held in the special chuck *B*. by the beveled flange. Roughing and finishing bars *C* and *D* are bolted to the face of the turret and also supported in a bushing in the lathe spindle.

The fixtures for the crosshead of this same engine are shown in Fig. 3. It is being held for boring for the wristpin at *A* and for the piston rod at *B*. This simply requires removing the crosshead and turning it through 90 degrees.

The tools require almost no explanation, the double facing cutter *C* being removable and used to face the inside of the cheeks of the crosshead hub. The reamers *D* are provided with stop collar to limit the depth, while the forming tool *E* rounds the end of the crosshead and makes a good finish.

Fig. 4 shows the method of machining the chain-driving pulley at *A*. This is first bored and reamed so that it can be mounted on and driven by the mandrel *B* which has a long key and also two projections *C C* which engage the studs on the faceplate *D*. The piece in *A* shows

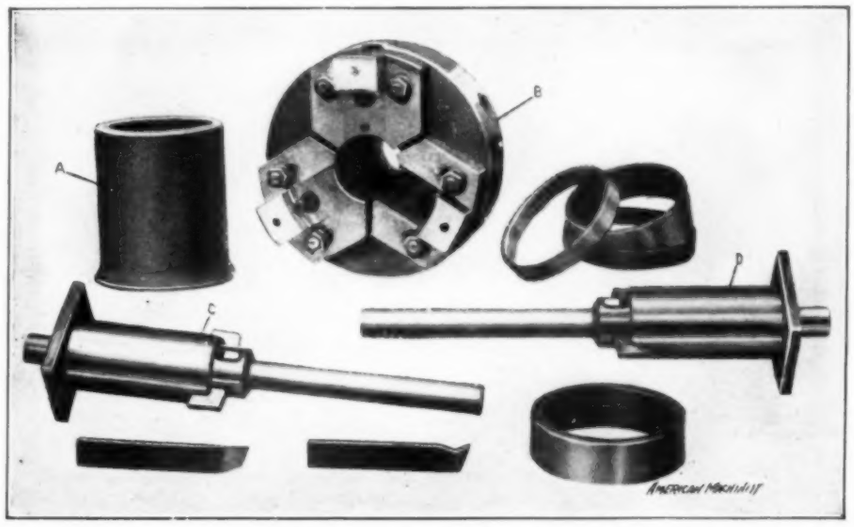


FIG. 2. EQUIPMENT FOR MAKING PISTON RINGS

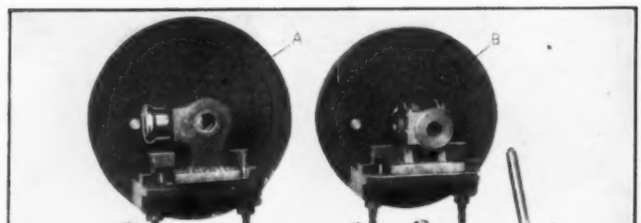


FIG. 3. TOOLS FOR MAKING CROSSHEADS

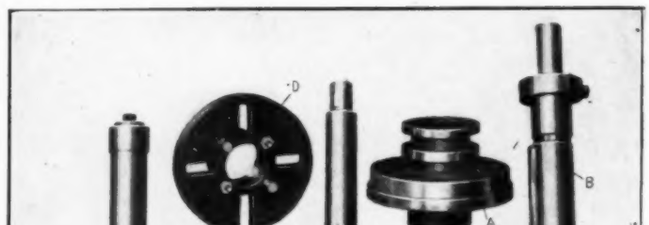


FIG. 4. MACHINING A CHAIN SPROCKET

the condition of the work after the first operation, the outside being turned as far as shown at the first setting.

The boring bars *E* are of the regular type and are supported at the front end by hardened steel bushing in the lathe spindle. The lathe tools shown are of the proper size and shape to cut the grooves shown in the first operation.

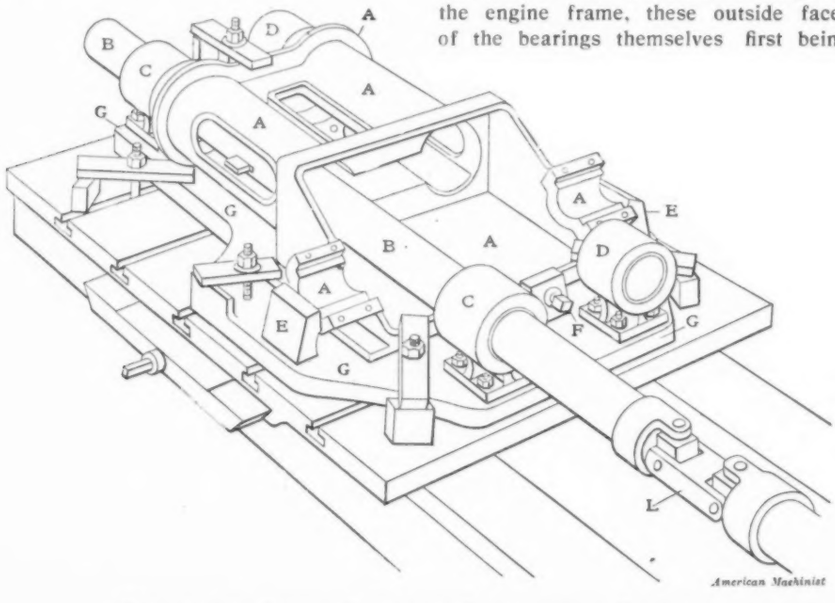
Large Crosshead Boring Fixture

Editorial Correspondence

A boring fixture that saves time and secures accuracy in making steam shovels.

In the accompanying illustration there is shown a jig used for boring crosshead guides of one of the double engines of a steam shovel manufactured by the American Locomotive Company, Rogers Works, of Paterson, N. J. In this illustration, the engine frame, which includes two crosshead guides, the crank case and the two main bearings, is represented by the letter *A*. The jig, which is a cast-iron plate carrying four bearings for the boring bars, and suitable lugs for locating the work, is represented by the letter *G*.

Boring bar *B* passes through the bearings *C C*, to bore out the left-hand guide as shown. The two bearings *D D* are used when the boring bar is transferred to the other side of the casting to bore out the opposite guide. On the jig the two lugs *E E* are planed on their inner surfaces to fit the dimension over the outsides of the two main bearings of the engine frame, these outside faces of the bearings themselves first being finished. These two lugs then locate the casting in a sidewise direction.



FIXTURE FOR BORING GUIDES OF STEAM-SHOVEL ENGINES

At the rear of the casting, between the two crosshead guides, there is another lug on the jig, which is planed on its front surface and against which bears the planed surface of the back flange of the engine guides. This lug locates the casting in the longitudinal direction, the screw *F* forcing the casting back against this rear lug.

Numerous clamps are placed around the casting and the jig, both to hold the casting to the jig and the jig to the table of the horizontal boring machine which is doing the work. In certain positions, also, permanent lugs are cast on the jig to act in the place of blocking under some of the clamps. The double universal joint with the link *L*, in the boring bar, accommodates for lack of alinement with the spindle of the boring machine, so that particular care in this regard is not required. In present practice only one side of the engine frame is bored at a time, it being necessary to transfer the boring bar to the other side of the jig, when the first side is finished, but arrangements are contemplated to drive two boring bars together, so as to complete the work in half the time.

Other jigs of a similar nature are also in use at this plant for boring two guides of twin engines with separate frames. These jigs are provided with boring-bar bearings for the engine main bearings and for the rocker-arm bearings, as well as those for the guides. By this construction it is then possible to do all the boring at one setting of the casting in the jig, it being necessary only to turn the jig at right angles when boring across the casting.

Dies for Offsetting Steel Angles

By S. Hurley

A design that requires but one operation of a hydraulic press to shape two pieces and also produces angles shaped right and left.

Offset angles are used for connections, braces, etc., largely in structural engineering work such as steel-car construction and the like. Standard steel angles bent in one or two places will very often eliminate the necessity for using packing pieces, and at the same time perhaps make a better job.

Whether or not any product is used extensively depends to a great extent on the cost of manufacture and the time required in getting the raw material into usable shape. It is here that the offset angle shows up to good advantage, for by means of the dies shown in the accompanying illustrations it requires but one operation of a hydraulic press to shape two pieces. Besides this the angles so shaped may be one right and the other left. And this is an important consideration because such shapes used for connections, etc., usually come in pairs, that is, the offsets are rarely at equal distances from the ends or of the same depth.

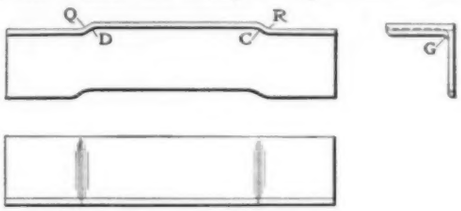


FIG. 1. Connection Angle

WHERE THESE DIES ARE USED

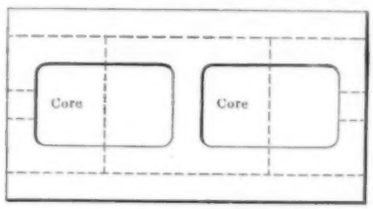
Dies similar to the ones here described for pressing steel angles are successfully employed in steel-car plants and other manufacturing establishments where structural steel is used. They are made of ordinary gray iron and usually operated in hydraulic presses of from 250 to 500 tons capacity.

A typical connection or reinforcing angle is illustrated in Fig. 1. As shown it is an ordinary 5x5x⅜-inch angle, about feet long, and has offsets, *G* and *R*, inch deep about 6 inches from each end. Two of these connections are pressed by one operation from straight 5x5x⅜-inch angles.

DESIGN OF BOTTOM DIE

When the dies for this work are designed it is customary to lay out the bottom one first and then to make the dimensions of the top one to correspond. The bottom die is made of two castings which are bolted up as shown in Fig. 3. A flange *F*, 2 inches square, is cast along the bottom on each side, by means of which it is clamped to the press. The clamps used for this purpose are of the ordinary U-type, common around machine shops.

The die is about 2 or 3 inches longer than the finished work, and for a 5x5-inch angle may be made 11 inches high at its lowest point, and each casting 5 or 5½ inches wide at the top. The hight is, of course, made great enough so that the leg of the angle will clear the separator *S* as shown in Fig. 4, and the width is usually a little more than the length of the leg of the angle resting on the die. The separator *S*, a detail of which is shown in connection with Fig. 3, may be 3 inches square and its thickness is usually twice the thickness of the angle, plus ⅛ inch clearance. For the angle shown it is ⅜ + ⅜ + ⅛ or ⅞ inch, thus making the total width of the die about 10⅞ or 11 inches.



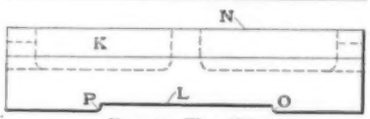
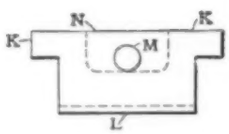
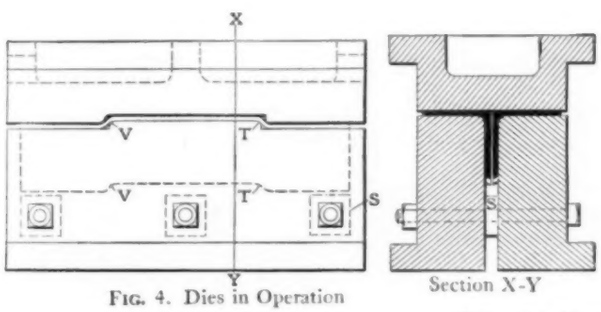


FIG. 2. Top Die





Section X-Y

FIG. 4. Dies in Operation

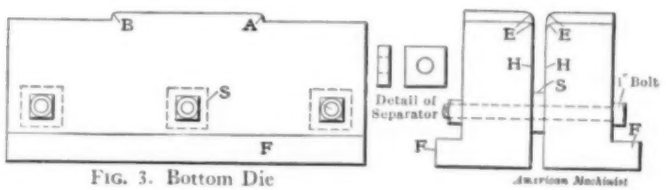


FIG. 3. Bottom Die

DIES FOR OFFSETTING STEEL ANGLES

THE WORKING SURFACE OF THE DIE

The castings comprising the bottom die are held together by inch bolts, with square heads and nuts, spaced from 10 to 15 inches apart and high enough to allow the nut to clear the flange *F*. The working surface of the die is offset, as shown, to the same depth as the finished work represented in Fig. 1. This offset need not follow the contour of the bend in the angle, but may be made straight, with the bottom corners sharp and the top corners *A* and *B* rounded off with radii equal to those at *C* and *D* in Fig. 1. This makes the die easier to finish than if the offset were the same shape as in the finished piece. The corners *E* should be rounded off with a radius about 1/16 to ⅛ inch greater than the inside corner radius *G*, of the angle. This die should be finished on the top, bottom and inside faces *H*.

DESIGN OF TOP DIE

The top die, Fig. 2, which is made of one casting, is designed after the dimensions of the bottom one are determined. The reason for this is obvious. The hight and width of the bottom die are fixed by the size of the angle, while the corresponding dimensions of the top die are not limited in this way. The combined hight of the two dies when their working faces are brought together should not be less than 16 inches, to be used in the press of the capacity mentioned, because it is not practicable to bring the faces of the press nearer together than this. On the other hand, for reasons of economy, it is desirable to have this combined hight as near the minimum as possible, being sure always to allow room for the clamps.

Following out this scheme, since the hight of the bottom die is 11 inches, that of the top one may be 16, 11 or 5 inches at a corresponding point. This will allow plenty of room for the clamps, for none of the work extends over the sides. The length and width of the die shown in Fig. 2 will, of course, be the same as the corresponding dimensions of that shown in Fig. 3.

Other Dimensions

As in the bottom die there is a flange *K*, 2 inches square, cast along either side to serve as a means for clamping to the press. The casting in Fig. 2 is cored out for lightening as shown, the cores usually being from 10 to 20 inches long, with 2-inch webs between. The metal at the ends and sides is left 2 inches thick, and between the working surface *L* and the core it is usually from 2½ to 3 inches. Holes *M*, about 2 inches in diameter, are cored in the ends of the die to enable the machinist to clamp the casting to the machine while the surface *N* is being finished. The working surface *L* is flat across, with offsets opposite to those in the bottom die, the radii at *O* and *P* being the same as those at *R* and *Q* of Fig. 1. This die is finished on top and bottom.

Allowing for Shrinkage

It should be remembered in working up dies of this nature that the angles are pressed hot, and so a suitable shrinkage must be allowed for. This is usually taken as about ⅛ inch to the foot. This means that, for instance, in Fig. 3 the distance between the offsets *A* and *B* should be made ⅛ inch per foot greater than the corresponding dimensions on the finished angle. It is found that in cooling the work will shrink about this much, and thus when cold it will be the required size.

Operation

The operation of pressing the angles is very simple. The dies are first accurately lined up and clamped to the press. Two straight angles are heated and placed side by side in the bottom die. The dies are then brought together, pressing the offsets in the angles as shown at *V* and *T*, Fig 4. They are next separated, the work is knocked out, and the press is in readiness for another operation.

It is evident that by this one operation a right- and left-hand piece can be shaped. Suppose, for example, the offset at *D*, Fig. 1, were not so deep as that at *C;* then *P* and *B* of Figs. 2 and 3 would be the same depth as *D*, and *O* and *A* the same as *C*. Referring to Fig. 4, it is seen that by having such a condition, two angles would result with the same offset in opposite ends. This, as before stated, is a valuable feature in any die because it saves making a right- and left-hand casting and also saves half the number of operations necessary in most other methods.

Measuring Spur Gears Accurately

By R. C. Thompson

A method of measuring the pitch diameter by means of rollers placed between the teeth instead of depending upon the outside diameter.

The accompanying sketch illustrates a method of accurately measuring involute spur gears which I have found very useful. I presume that this same method may have been worked out by someone else previously, but I have not known of it being used.

I was led to work out this method owing to the difficulty found in inspecting gears for our high-speed automobile motors. Gears which were cut by outside firms and which would run with each other in sets, at correct center distances, with a proper amount of backlash, would not run correctly with gears which we cut ourselves, although our gears would run on correct centers with each other. We found that the main trouble seemed to be in getting the first or master gear cut to the correct depth, so that when the next gear of the set was cut to run with this on an accurate test plate the backlash would be divided evenly between the two gears; that is, each gear would be cut the same amount deeper than standard.

By the method shown the desired amount of backlash is taken account of and gears which measure correctly by this method may be placed on plugs at the correct center distance, and by testing between the teeth in mesh with a thickness gage or "feeler" they will be found to have the exact amount of backlash desired.

This method is much more accurate than using a tooth caliper owing to the difficulty of holding the tooth caliper exactly in place on the tooth, also as a small variation in the width of the space between the teeth produces a much larger variation in the reading of the micrometer over the rods the error in cutting is shown multiplied.

After finding the proper diameter of the rods *D* to be used, and the value of *R'* from the formula, the measurement is taken over the two rods with a pair of outside micrometer calipers. The correct reading for the calipers is the pitch diameter of the gear plus *2R'*.

If the gear to be measured has an uneven number of teeth it is necessary to know the exact outside diameter of the blank before cutting and the measurement is taken over the top of a rod in a space and the top of the tooth exactly opposite; the correct reading for the micrometers in this case being one-half the pitch diameter of the gear plus *R'*, plus one-half the diameter of the blank.

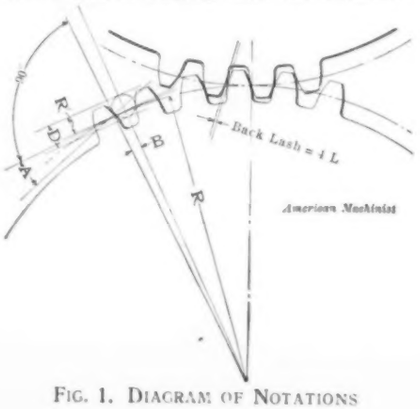


Fig. 1. Diagram of Notations

The formula holds good for involute gears of any angle of pressure. For continuous use the rods should be hardened and ground to size, and then magnetized so as to cause them to cling to the gear making; it is much easier to measure over them.

The diameter of the rods should be figured to the fourth decimal place and the rods held within 0.0001 of size for accurate work.

In solving the formula it is desirable to use a table of natural functions giving the values to the fifth decimal place, especially on large gears of fine pitch as the smaller the angle *B* the greater the error arising from the use of an inaccurate table.

Let

R = Radius of pitch circle.
N = Number of teeth in gear.
A = Angle of pressure.

$$L = \frac{\text{Desired backlash}}{4}.$$

$$B = \frac{90^\circ}{N}.$$

D = Diameter of rod to use.
R' = Distance from top of rod to pitch circle.

Thus

$$D = 2\left(\frac{(R\ sin.\ B) + L}{cos.\ \overline{A + B}}\right).$$

$$R' = \frac{(R\ sin.\ B) + L}{Cos.\ \overline{A + B}} + [(R\ sin.\ B) + L]$$

$$[tan.\ \overline{A + B}] - R\ (1 - cos.\ B).$$

Molding Bulldozer Frame

By Jabez Nall

Problems solved by the molder in making this casting in the floor. Preparing the mold pit and bed with holding down bolts, vents, gates, risers, etc. Bedding the pattern, ramming it up, making the partings and locating the gates. Cope made in two parts, butted together; reinforcing and locating it. Methods employed in making, locating and fitting the cores. How strains are prevented and contraction controlled.

In the molding of such a casting as is shown in the accompanying illustrations, there are many points of interest, not only to the foundry man, or molder, whether a learner or experienced, but also to all that are interested in the production or handling of castings. Especially is this so when it is made of a high-grade cast steel, owing to the increased difficulty in controlling the metal.

The extreme amount and rapidity of contraction is liable to cause strains, and cause the metal to crack or part company altogether if the strain be too great. Taking into consideration the design and metal distribution of the casting as shown, a problem is presented in foundry practice that calls for skill and intelligence on the part of the molder. How the casting was successfully made, under the direction of foundry superintendent Hoover, of the Cleveland Steel Casting Company, is shown in the story that follows.

As it is to be expected that many machinists will see this article, and rightly make it a subject of criticism it may not be out of place to add a few words on that subject. While it is true that the molder is not required to work to any microscopic measurements, this being impossible with the material with which he has to work, still there is much in the trade that calls for skill.

Molding a Flat Plate

Take for instance the making of a common, flat, plate casting. This seems a very simple proposition and one that calls for little skill or thought; yet there are many things to be considered by the molder. A thick plate requires different ramming from a thin one. If thin and of large area the metal must be gotten over the surface quick enough to not set up strains; be homogeneous and solid, and not show seams as the metal rolls together. Warping or distortion must also be prevented; a thick plate acting differently from a thin one. Whether this shall be attained by different gating, cambering the mold, different stripping while cooling, weighting the casting while cooling, or some other means are problems for the molder to solve.

This leaves out of the question all such matters as venting; the best kind and arrangement of gates and flow off; the handling and clamping of the flask, and if large the weighting of the flask; the placing of these, and the amount required; to say nothing of the mixing of the metal and the temperature at which it shall be poured to get the best results for the job in hand.

Molding Skill

These and other considerations show that it requires considerable skill to build a mold structure in sand, for making such a casting as forms the subject of this article. It must be strong enough to withstand the pressure of the metal and retain its shape, yet porous enough to emit the gases freely, and at the same time sufficiently yielding to not unduly resist the pressure of the contraction of the metal, and thus cause strains or cracks to appear in the casting. The reader who cares to figure out these strains and pressures will find them enormous.

Preparing Bed

In molding the frame casting under consideration, or in fact any large casting, there is much preparatory work to

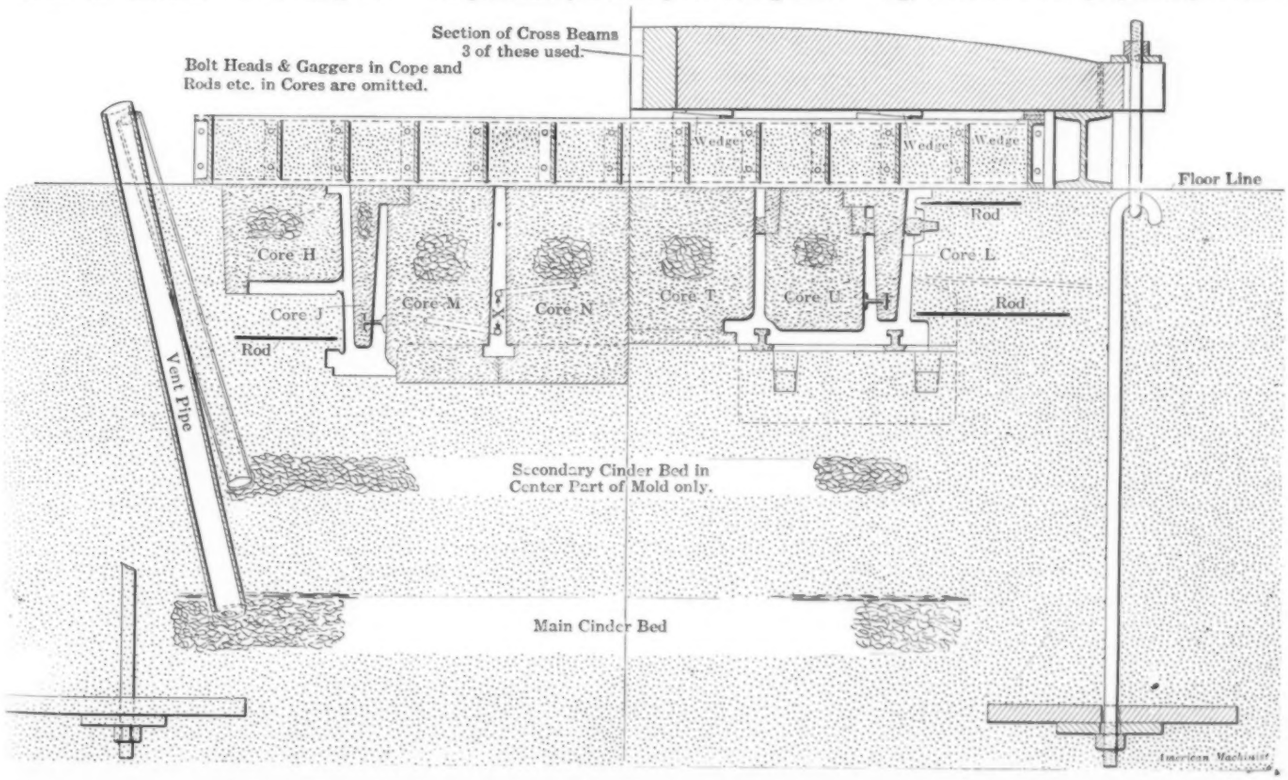


Fig. 1. Sectional View of Floor Mold of Ajax High-speed Bulldozer Frame

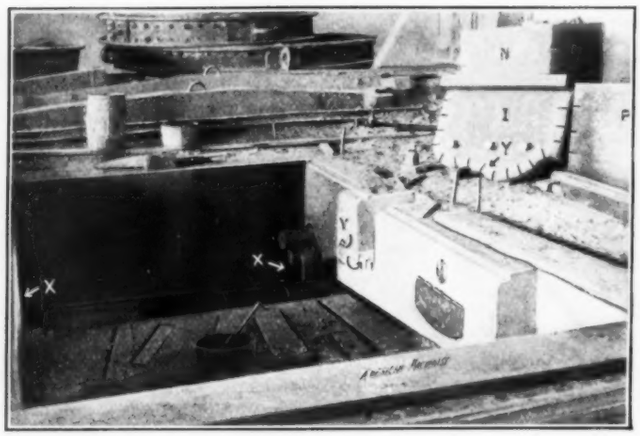


FIG. 2. THE MOLD READY FOR THE CORES

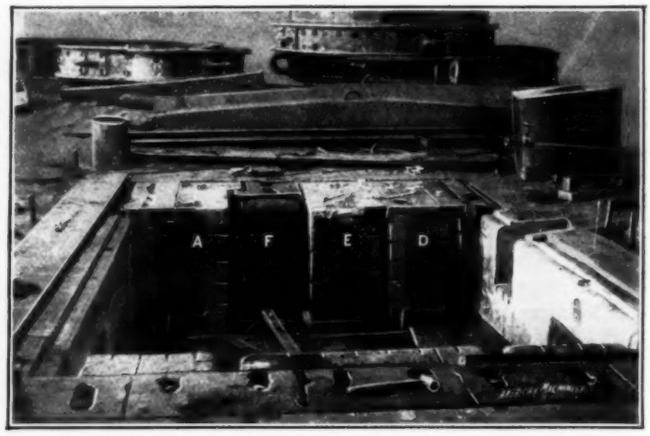


FIG. 3. THE CORES IN BOTH ENDS OF THE MOLD IN POSITION

be done. The first thing required is a molding pit; this, of course, must be sufficiently large to contain the job, and is usually of a semi-permanent nature. The plates to which are attached the holding-down bolts are sometimes square or circular and 30 to 36 inches in size, or they may be long enough to pass through the bed from side to side. Fig. 1 represents a cross-section of the mold and the plates as shown, are of the individual type. When the plates are made in one piece crossing from side to side, with a bolt at each end, they usually get broken in the center by frequent use.

With these plates firmly bedded in the sand, a bed of coke cinders 6 to 8 inches thick is made above them, and this vented. The cinder bed and vent pipe forms a safe and quick passage for the gases, from the mold to a point, or points, above the surface of the floor, and beyond the limits of the mold. One of these pipes may be seen at *A*, Fig. 4. Above these cinders there is usually a thin layer of straw, which to some extent prevents the cinder bed from clogging with sand, while ramming about 6 inches of sand on top. This must be rammed firmly and vented freely. This concludes the preliminary work and the molder is ready for the pattern.

BEDDING PATTERN

In this case both extremities of the pattern were so much deeper than the center, that the pattern was first set up in the molding pit so the proper hight of bed could be measured, or staked, in order to bring the top of the flange on a level with the foundry floor. See Figs. 1 and 2. This done the pattern was removed and boards were set and braced at each end, and to the proper hight and angle.

The center bed, upon which the pattern is to rest and which would be inaccessible with the pattern in place, was then rammed solid. The body of this was ordinary heap sand with a layer of specially mixed facing sand on top. The sand at this point was now so high above the main cinder bed, that it was necessary to build in a secondary cinder bed, as shown in Fig. 1, in order to properly vent this part of the mold. The ends of this sand were strengthened by laying in short rods. The ends of the mold being rammed to the approximate hight, the pattern was returned to place, and bedded, by pounding down with a sledge.

The pattern was tested by spirit level and again lifted off to examine the impression. This was corrected and the pattern again returned to place. Then comes the undesirable job of tucking the sand under the rest of the pattern. The patternmaker should keep in mind the inconvenient posture that the molder is compelled to assume when doing this part of the work, and construct the underside of the pattern as simple as possible.

The pattern being properly bedded and the loose parts, pieces or core prints, that belong on one side, doweled in their respective positions, the sand was rammed to the top of the pattern on this side. It was faced about 1½ inches thick with mixed facing sand, backed up with heap sand. This was strengthened by rods, especially so at any overhanging sand, as shown in Fig. 1.

GATING

Another thing that deserves special mention is the arrangement for pouring the casting. These were built into the rear wall of the mold, as seen in Fig. 2. The upright runner is shown covered by

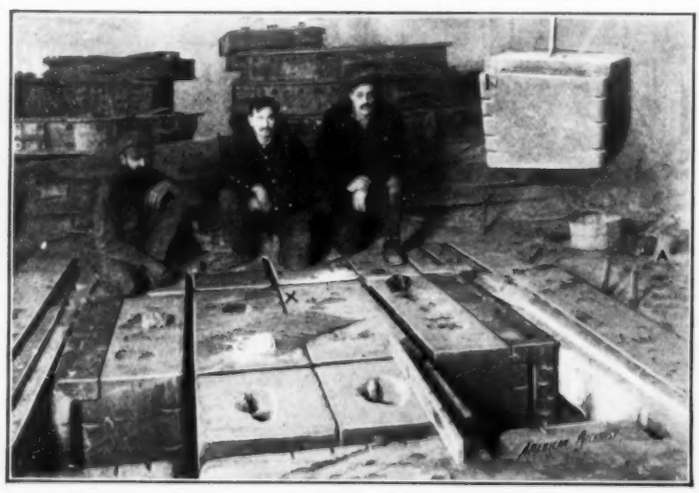


FIG. 4. SETTING THE LAST TWO CORES

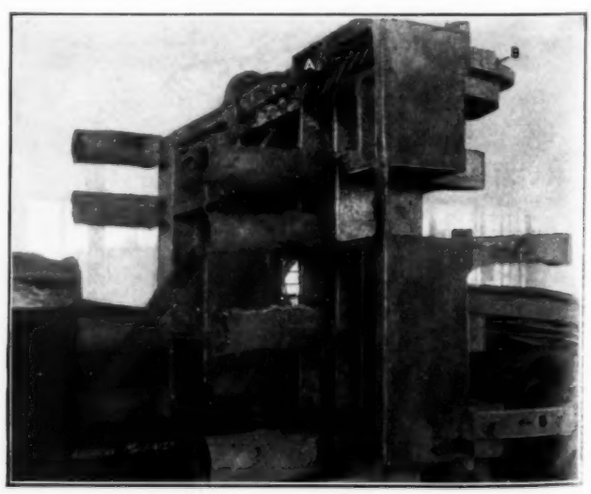


FIG. 5. THE CASTING AS IT LEFT THE MOLD

a plate at *I*, while the gates proper or inlets where the metal enters the mold are at *X*. Connecting these is a channel formed by cores and covered by a slab core. It is further strengthened by a plate or plates, laid on top.

After the mold is assembled, this runner is carried to a hight equal to or above the required feeding head. The position of these gates on the casting are shown at *B*, Fig. 5. Before placing the cope, the position of the feeding heads must be located. For this purpose, if no other, the lines of the metal should be clearly shown on the cope side of the pattern. In this case, it was necessary for some metal to be added to the corner of the ribs in cores *E* and *F*, and at the side walls of the casting *fin* core *I*, to give sufficient metal to prevent "freezing" before the head gets in its work. These additions may be noted in Fig. 4. In Fig. 5 is shown the number and location of these heads, which have been partly cut off by melting with the electric welding apparatus. The one at *A* was entirely removed. The three in the front are 10 inches in diameter, and the four in the back are 12 inches. This pressure ought to, and did result in a good, solid casting.

The Cope

For conveniece in handling and drying the cope, as well as economy of floor space, the cope was made in two parts, that were butted together at about the center of the mold. The ramming of the cope complete, it was removed and finished. The body of the pattern was then withdrawn and the loose parts drawn into the space left by the removal of the body of pattern. The whole mold was then gone over and finished; the sand at all metal surfaces being further reinforced by nails, about two inches apart.

More patching is required if the pattern be rough or the varnish be unsatisfactory, as the heat or moisture, during the several days it is in the sand, will cause the sand to adhere to it, more than is compatible with good work or the molder's temper.

The finished mold is then given a coat of wash and dried by natural gas; special pipe burners being used and the mold covered with sheet iron.

Core Work

In the preparation of the cores, there needs be little special mention, as the changes in the boxes, etc., have been noted in the preceding article. The amount of rods, etc., that go into the building up of these cores may be inferred by a glance at the few cores yet left in the casting shown in Fig. 5.

One point that may be mentioned at this time is the necessity for careful work on the part of the core maker in constructing cores that will approximately keep the required dimensions. This includes care in mixing and grinding the sand, and also in even ramming. More important, however, is the matter of clamping and supporting the bottom board of the box, to prevent its sagging. In the case of large cores, it is not infrequent, after the core is rolled over, to see that the sand is ⅛ inch or more, higher than the sides of the box. This may be due to the cause mentioned or to the careless handling of the core in the chains, when rolling.

This amount of error may be considered small by some core makers, but if we multiply this by four cores in a line as cores, *M*, *N*, *O* and *P* in this casting, it amounts to ½ inch.

Fitting Cores

In the case of the cores mentioned, the box was made fully ⅛ inch small in depth; the patternmaker estimating that the core would probably sag in this direction when drying. This allowance should be sufficient, but the result showed that the cores totaled ½ inch too much. This ½ inch had to be dug off the blank side of the center core *N*, where it abuts core *T*, in order to get the required metal thickness, hence the rough line as seen at *X*, Fig. 4.

The front cores shown in Fig. 3 were made from the one box, but in this case the core is rammed up in the opposite position to cores *M* and *N*, Fig. 1. This box was made with an allowance, when spaced off on the print, of 3/16 inch, but when placed in position, the cores showed that this allowance should have been at least 1/16 inch more, making ⅛ inch on the width of each core. Between the swelling of the mold and the swelling of the cores, when front cores in Fig. 3 were in place, ⅝ of an inch had to be cut off the sides of core *X* to make the casting come right.

Placing Cores

The mold being dry and the cores ready, the next thing is placing the cores. Fig. 2 shows the side cores in place. The round cores for the main shaft bushings are also resting in the prints in these side cores as well as two of the end babbitt-bearing cores. The nameplate core was set when finishing the mold. The round cores for the main shaft are set in a print at the side of the mold and the other end is held down by cores *D*, *E*, *F* and *A*. This round core, for both convenience and economy, was made in two pieces as shown.

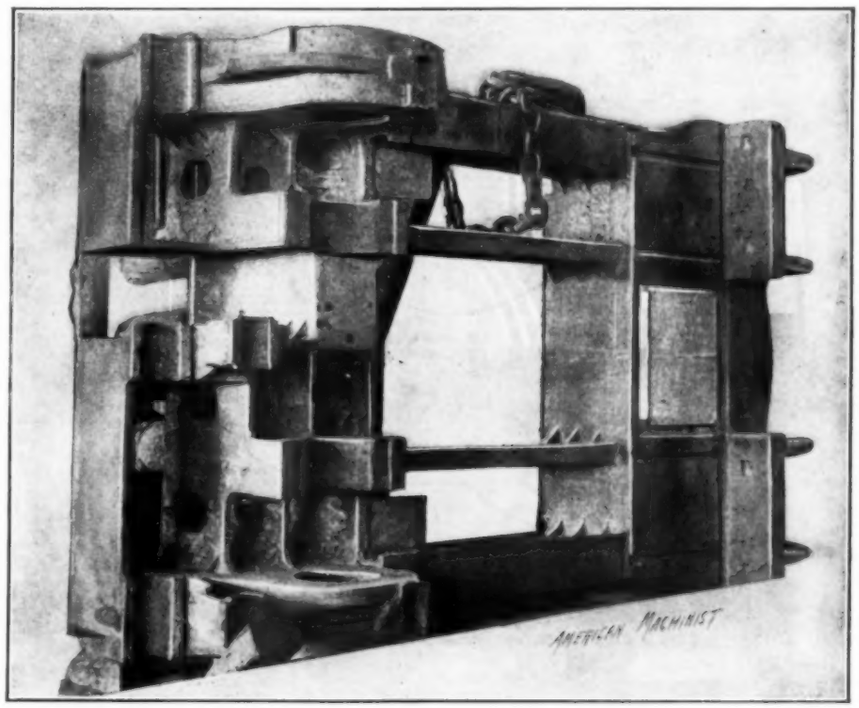


Fig. 6. The Finished Bulldozer Frame Casting Ready to Ship

Cores for the oil pockets and secondary shaft are set but cannot be seen. In Fig. 3 is shown further progress in coring up. In this view cores *D*, *E*, *F* and *A* were set in the order named, also the side cores, and this completed this end of the mold. The arrangement for supporting and also venting core *I* is better shown to the right of Fig. 2.

In the foreground of Fig. 3 is shown the line of cores before mentioned; they being set from each end. The cores that have been added, but not visible, are the cores for the T-slots, the cores for tool clearances at the toes, and also for the square head for the adjusting screws.

It was intended to core four 1¾-inch holes in addition to and connected with the square-head cores. On the advice of the foundryman, however, it was decided to leave these out and drill the holes as

the amount of metal surrounding the cores would make it impossible to insure a clean hole.

In Fig. 4 is shown the coring of the mold nearing completion, the only ones not in place being the two small cores for the treadle shaft, and core *L*. Core *U* is hanging from the crane ready to be lowered into position.

With the cores placed, all that remained to do was to place the cope, clamp it down, build up the heads, and arrange the runners and flow off.

The principal difficulty with a casting of this character is the control of the contraction and the prevention of the strains that cause the casting to crack.

This is done, in part, by the ramming and composition of the sand mixture. All corners and weak spots are taken care of by "stitching." These are small notches cut in the corners of the cores and at the corners of the mold as seen at *Y*, Fig. 2. They form light corner ribs on the casting that set quickly and tend to bind the corners, when the contraction of the two side plates would otherwise pull them apart at the point where the metal was thickest.

To further reinforce these corners, as well as the long ribs, ¾-inch rod, hooked over 10 or 12 inches at the ends, was set in the mold as indicated in Fig. 1. That these methods combined proved successful is shown in Fig. 6, which is the finished casting. The shipping weight approximated 28,000 pounds.

Tools for Pressing Steel Covers

By W. F. Hoffman*

In the making of steel terminal covers the usual method is to use compound blanking and forming dies for the first operation and then trimming and piercing. The method here described is the reverse, is more rapid and eliminates danger to the operator's hands.

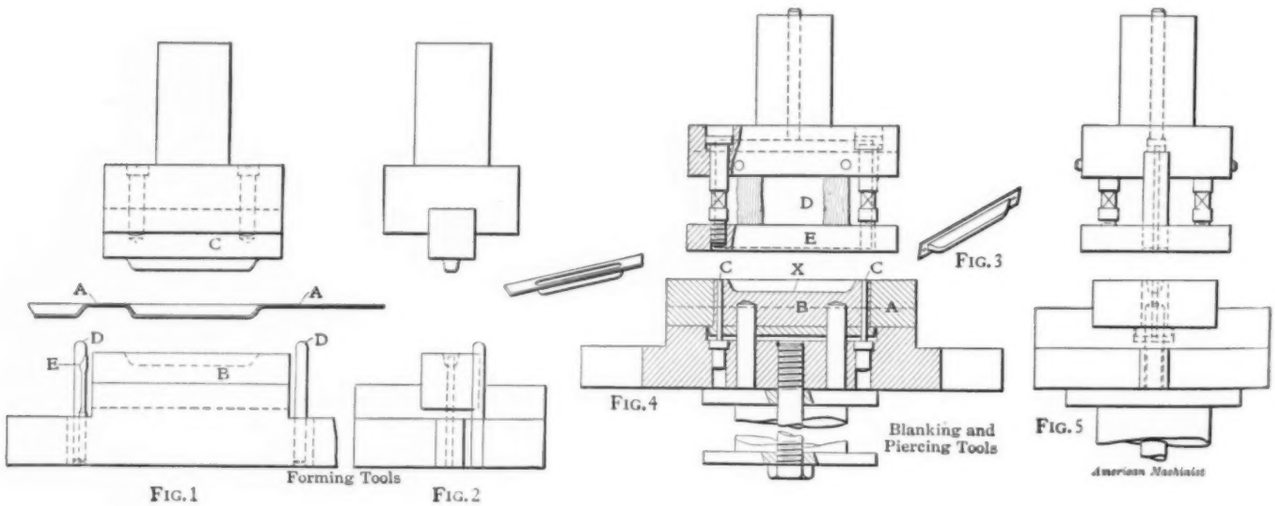
*Superintendent, American Automatic Telephone Company, Urbana, O.

The accompanying sketches, Figs. 1 to 5, show the dies used for producing the metal cover shown in Fig. 3. The usual practice in making pieces of this kind seems to be to use compound blanking and forming dies, blanking and forming the piece in one die at one operation, then trimming and piercing at a second operation in a trimming die. This necessitates the handling of the piece after the first operation, to place it in the trimming die, which is slow and also brings the press operator's hands under the dies.

By using the dies as herewith shown, the method of making these pieces is the reverse of the one just described. This method consists in forming the piece first in the strip as shown at *A*, Fig. 1, that is forming or making the depressions the entire length of the strip and then for the second operation piercing the small holes and blanking the finished cover out of the strip. In Fig. 1 is seen the forming die, which is very simple in construction, there being no tension pad required as the cover is but ¼ inch deep. At *B* is shown the die proper, at *C* the punch, at *D* the guide pins for the strip, and at *E* the stop for locating the strip. Fig. 2 represents the end view of the punch and die.

In Fig. 4 is illustrated the compound piercing and blanking die and punch. The construction of this die will be readily understood; a brief explanation will, however, be given. *A* is the blanking die; *B* the supporting pad and stripper for the piercing punches *C C*; *D*, the compound blanking punch and piercing die; and *E* the stripper. The formed strip is placed in the pad *B* at *X*, and the press is then operated. The metal is 1/32 inch in thickness, so very little movement is required for the piercing and blanking operations, both of which are done simultaneously.

The piercing punches *C C* are set into mild-steel plugs and are easily replaced. The supporting pad and stripper rests on studs and they in turn on a rubber buffer. Fig. 5 shows an end view of the punch and die. These tools are easily operated and their upkeep is reduced to a minimum.



PRESS TOOLS FOR MAKING STEEL TERMINAL COVERS

The utility of concrete for barge construction will soon have practical test. The first of the three concrete barges for use in Panama Canal work was recently launched, and some are very sanguine in their expectations as to how the barge will behave in actual work. These barges will draw 3¼ feet.

Flangeless Shoes and Wedges

By Charles Markel

Flanges on locomotive driving-box shoes and wedges are in many instances a source of trouble, often cracking and breaking.

The flangeless type permit ready adjustment, make the machining operations less troublesome and more economical.

The illustrations, Figs. 1 and 2, show what are termed locomotive flangeless shoes and wedges. The prints show the shoe and wedge and side plates in position on frames, also giving details of its construction. The plates you will note are riveted to frame jaws by ⅝-inch hot rivets, are cold-rolled machine steel and the only labor required on them is to cut to length drill holes and rivet to jaws. When they become sufficiently worn by action of driving box, duplicate plates can be applied at small cost. The wedges are simply flat pieces of cast iron and can be machined for one-eighth the cost of present flanged wedge. The shoes are made from machine steel and only require machining on one side. The advantages of this device are as follows: No flanges on shoes or wedges to crack or break; wedges can be readily adjusted because there are no flanges to stick to sides of frame jaws; shoes can be made from bar machine steel and will only require cutting off to length; wedges can be machined for one-eighth the labor cost, as planer bed can be filled with them as the work is straight planing, no flanges to contend with; this method gives 1½ inches more bearing to shoes and wedges on jaw faces, which is quite an advantage.

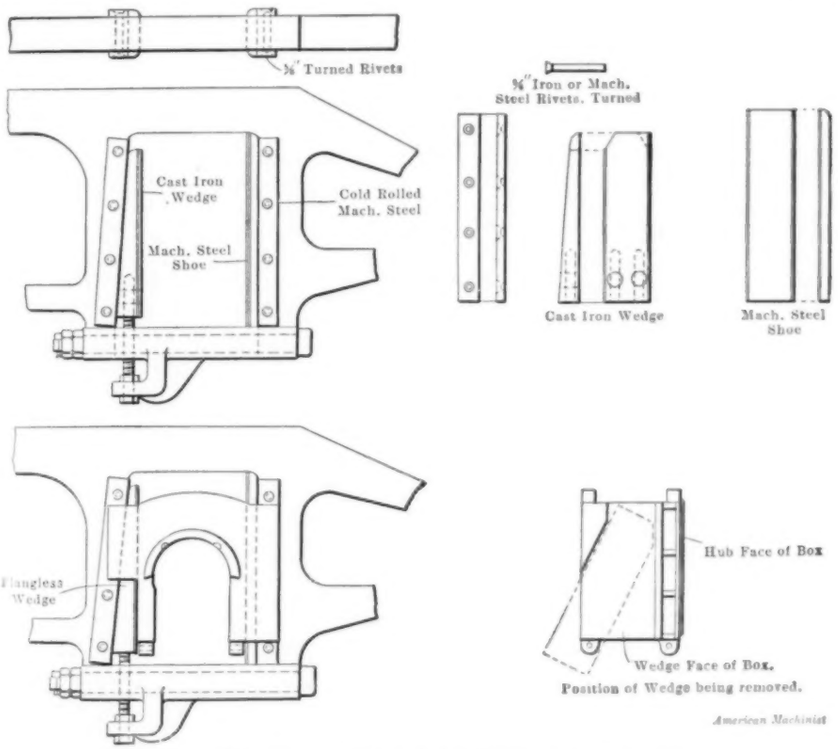


FIG. 1. LOCOMOTIVE FLANGELESS SHOES AND WEDGES
FIG. 2. DRIVING BOX USED WITH FLANGELESS SHOES AND WEDGES

This style of shoes and wedge is past the experimental stage as it has been in use on the Chicago & North Western Railway since May, 1907, and is now being applied to all new power being built on Atlantic, Pacific and consolidation power.

The cuts and explanation fully cover the new method of using flangeless shoe and wedges. In connection wish to say that our wedges for Atlantic type engine cost us $3.07, flangeless wedge costs $1; standard shoe costs $2.34; flangeless shoe costs $1.50. This makes a saving of $3.91 on one shoe and wedge or $15.64 on shoes and wedges for four-wheeled engine. As there are no flanges to crack and break on these shoes and wedges, they will last for years, by applying liners on them to take up wear on boxes. The cold-rolled steel plates that are riveted to frame jaws cost for labor and material on four-wheeled engine, $3.75.

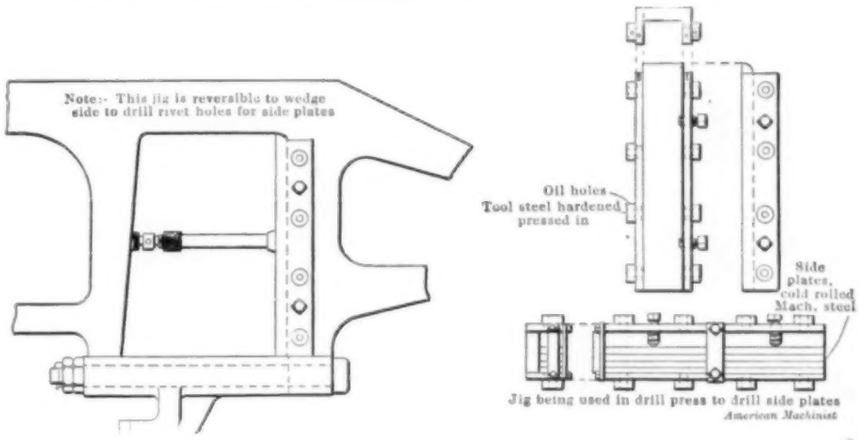

Note:- This jig is reversible to wedge side to drill rivet holes for side plates
Oil holes
Tool steel hardened pressed in
Side plates, cold rolled Mach. steel
Jig being used in drill press to drill side plates
American Machinist

FIG. 3. JIG FOR LOCOMOTIVE FLANGELESS SHOES AND WEDGES

It now takes us five hours to line down one standard flanged wedge, at labor cost of $2.80. It takes one hour to line down the flangeless wedge, at labor expense of 56 cents, saving of $2.24 in lining down one wedge. This saving is caused by simply having to remove the wedge bolts, when wedge can be taken out; no taking down of binder bolts and other parts.

This engraving shows part of flange removed on inside of box at wedge side, and allows the wedge to be taken down and liner put on, by simply removing the wedge bolts. No taking down of binder or dismantling any other part of engine. This wedge can be lined down in one hour where it now takes five hours to line down the flanged wedge. As there is no wear or work on inside flanges of driving boxes, the removal of this flange does not weaken the box in any particular.

A CHEAP DRILL JIG

Fig. 3 shows the original shoe converted into drill jig by simply locating hardened steel bushings in flanges of shoe. This one jig is used in drill press to drill four side plates at one time, and after plates are drilled, the same jig is placed on frame jaw and rivet holes drilled from each side through frame jaws. It also shows drill jig held in place ready to drill holes through frame.

Putting Carbon into Steel

By Philo Kemery * ·

The various methods of adding carbon to steel in order to obtain the different grades for varying conditions of work to be performed. Effects of carbon during the hardening and annealing processes.

Before entering into the subject of carbon, it will be well to understand what is meant by a chemical change. When two elements unite, they form a compound whose chemical and physical properties are entirely different from either of the constituents that enter therein. This is a difficult statement to comprehend without some examples.

It will be well, therefore, to start with the equation $3Fe + C + 2200$ degrees F. $= Fe_3C$. In this chemical equation we have two elements, namely, iron and carbon. They do not unite under ordinary conditions, but when we modify them by increasing the temperature to 2200 degrees Fahrenheit they do unite; this being a favorable condition for the union of these two elements and they then form the compound Fe_3C, which is known as cementite, in the metallography of iron and steel. This cementite is entirely different in both its physical and chemical properties from either the iron or the carbon of which it is composed.

Chemical Changes

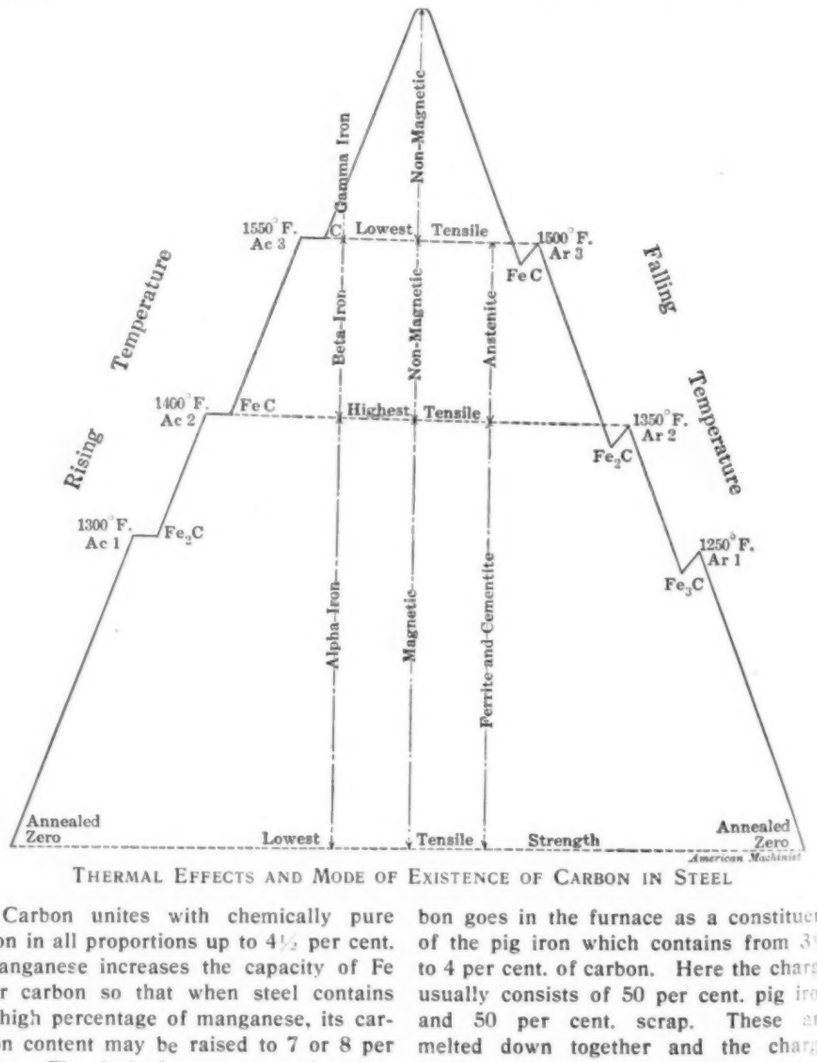
As a second example, take the equation $2H_2 + O_2 +$ platinum $= 2H_2O +$ platinum. This is one of the most delicate reactions known to chemistry and in it hydrogen and oxygen are united by platinum to form water. When two volumes of hydrogen and one volume of oxygen are mixed together under a bell jar and a piece of cold platinum is immersed therein, there is immediately formed over the surface of the inside of the bell jar, a deposit of moisture. This means that the hydrogen and the oxygen have been chemically united, while the platinum undergoes absolutely no change. It is acting by its presence alone, which is called catalytic action.

For a third example, take charcoal, which is nearly pure carbon and under ordinary conditions is stable. When submitted to the chemical change represented by the following equation: $C + O_2 + 1100$ degrees F. $= CO_2$. Thus, raising the temperature to 1100 degrees causes a chemical change to take place and the charcoal is turned to carbon dioxide, or a solid to a gas.

Chemical Conditions

In these three examples the elements all have characteristic properties that are entirely different from the compounds they form. In the first, two solids are united by means of heat to form a third solid; in the second, two gases are united to form a liquid, water; and in the third, a solid is converted into a gas. All three show how important it is to have the proper conditions in order to make the desired change. Conditions are everything to the chemist and metallurgist, as well as to the practical mechanic, who has to handle the metals and treat them in various ways. Certain definite temperature conditions favor certain reactions, while higher temperatures cause disassociation.

*Metallurgical engineer, Crescent Steel Works, Pittsburg, Penn.



Thermal Effects and Mode of Existence of Carbon in Steel

Carbon unites with chemically pure iron in all proportions up to 4½ per cent. Manganese increases the capacity of Fe for carbon so that when steel contains a high percentage of manganese, its carbon content may be raised to 7 or 8 per cent. The desired percentage of carbon in steel is obtained in various ways.

Crucible Process of Adding Carbon

In the crucible process, if we wish to make a 1.0 per cent. carbon steel in a crucible pot, we weigh out 15 ounces of charcoal and 100 pounds of muck iron. The pot is then covered and sealed to prevent the air from attacking it, after which it is placed in a furnace and the charge melted down. Assuming that muck iron contains 0.1 per cent. of carbon, when this charge is melted the iron absorbs all the carbon from the charcoal and when cast into an ingot, this ingot, when analyzed, will show about 1.0 per cent. of carbon. Usually the muck iron runs higher than 0.1 per cent. in carbon and the amount of charcoal has to be increased or diminished, according to the carbon contents of the muck iron.

Open Hearth Process of Adding Carbon

In the open-hearth process, the carbon goes in the furnace as a constituent of the pig iron which contains from 3½ to 4 per cent. of carbon. Here the charge usually consists of 50 per cent. pig iron and 50 per cent. scrap. These are melted down together and the charge boiled until the carbon, which oxidizes out, has been reduced to the proper percentage. When the bath is melted, a test is taken to obtain the carbon contents at the time of melting; 30 or 40 minutes

later another test is taken to see how fast the carbon is being reduced, and every 30 or 40 minutes thereafter other tests are taken to find the carbon content and determine when it has been reduced to a little below the desired percentage. When this point is reached, the ferro alloys, such as ferromanganese, ferrosilicon, etc., are added and these raise the carbon from 6 to 8 points.

After this, the heat is immediately cast into ingots and should contain the desired carbon percentage. In the open-hearth process it is better to catch the carbon where it is wanted as it is burned down and out rather than attempt to build it up. If a 1.0-per cent. carbon steel is desired and the bath only shows 0.7 per cent. it is almost useless to try to build the carbon up to the desired 1.0 per cent.

Bessemer Process of Obtaining Carbon Content

In the Bessemer process the molten metal is run into the converter, which usually holds about 12 tons, and blasts of air, that blow directly up through the metal, are blown into the bottom of the furnace. This blast of air raises the temperature of the bath and oxidizes out all of the silicon and manganese and nearly all of the carbon in from 6 to 8 minutes. The operator watches the flame that leaves the converter and by this he can tell when the carbon is down to point 70, point 60, point 50, point 40, or any percentage desired. The blast is then stopped and the metal cast into ingots. In the bessemer process the carbon can also be almost entirely oxidized out, and the bath recarburized to obtain the desired percentage of carbon.

Cementation Process

The above are known as the melting-in processes, but there is another that is radically different from these in that it puts the carbon into the solid metal. This is known as the cementation process.

One method consists of converting muck iron into blister bar. A layer of muck or wrought iron containing about 0.1 per cent. of carbon, is placed into the bottom of a specially prepared furnace, over this is laid a layer of charcoal and then alternate layers of muck iron and charcoal until the furnace is filled. Over the top of the last layer of charcoal is placed a heavy layer of clay to prevent the charcoal from burning off. The furnace is then heated up slowly for a few days, and held at a good yellow heat for about nine days, at the end of which time the iron has absorbed about 1.0 per cent. of carbon. The furnace is then cooled down and the bars withdrawn.

This product is known as blister bar or converted iron. It is used largely in the making of high-grade tool steel, as all that is necessary is to break it up into suitable sizes to go into the pot and melt it down with the necessary amounts of manganese and silicon, and cast into ingots.

Carbonizing Armor Plate

The cementation process is also used in the manufacture of armor plate, which in its initial state contains about 0.25 per cent. of carbon, 1.25 chromium, and 3.5 nickel. In this condition the plate is too soft to withstand the impact of a shell and more carbon is added to the outer surface to harden it.

Over the top of the plate from 4 to 5 inches of charcoal is laid and this luted down with a heavy coating of clay to prevent the charcoal from burning off. It is then placed in a furnace and the heat turned on. About ten days is consumed in slowly heating the plate up to from 2200 to 2350 degrees Fahrenheit and the temperature is held constant at this point for another ten days; after which it is allowed to cool down slowly for the third ten days.

It thus requires 30 days to Harveyize an armor plate, as this process is called, and it is then removed and heated and hardened in oil. This makes the Harveyized surface so intensely hard that no tool will cut it, while the center is tough enough to make the plate withstand the impact from any shot. About 0.9 per cent. of carbon has been added to the Harveyized surface, which it penetrates to a depth of from 1 inch to 1¼ inches.

The Krupp process of cementing armor plate is similar to the Harvey, but in place of the charcoal, illuminating gas is used. The armor plate is placed in a suitable furnace and heated up to a good yellow heat and when in that condition ordinary illuminating gas is run over the surface; when the gas comes in contact with the hot plate it is decomposed into carbon and hydrogen; the carbon being deposited in a finely divided state as soot, which is greedily absorbed by the plate, while the hydrogen escapes as a gas. The same percentage and depth of carbon is obtained by this process in about six days.

Carbonizing Small Pieces

The cementation, or as it is commonly called carbonizing process, is also used to add more carbon to an outer shell on parts used on various kinds of machines. In this process a low-carbon steel is usually used; one containing not over 0.15 per cent. of carbon giving the best results. The metal is surrounded by charcoal, bone or any other carbonaceous material, in an iron box, which is sealed up and placed in a furnace and submitted to as high a temperature as it will stand.

Another process has been developed along this line, which consists of placing the work in a revolving retort in a specially designed furnace and forcing into the retort carbonaceous gases that cause the steel to absorb the desired amount of carbon. This does away with the necessity of packing the metals.

In both of these processes the time consumed is governed by the depth of carbon desired in the metal, and as the pieces are small, the time is measured by hours instead of days. The steel can afterward be heat treated at any temperature desired.

Flowing of Carbon

Therefore, in general, it does not matter what the carbonaceous material is, if it is placed in contact with soft iron or mild steel and heated the carbon will flow from the carbonaceous material into the iron, as it always flows from the high to the low point. In fact, two pieces of steel or iron, one containing 0.1 per cent. carbon and the other containing 2.4 per cent., if placed face to face and heated up, will have the carbon flowing from the high to the low until equilibrium is established. In this case the equilibrium will be established when each piece has 1.25 per cent. of carbon. In its action it is very similar to the difference in potential of an electric current that causes it to flow from a highly charged body to a lower.

Mode of Existence In Steel

Having the carbon in the steel, the next point to consider is how does it exist there. The following is a list of the terms used in the metallography of iron and steel and their definitions.

Ferrite—Carbonless iron. (Fe).

Graphite—The carbon that does not combine with the iron.

Cementite—Three atoms of iron combined with one atom of carbon. (Fe_3C).

Pearlite—Alternate layers of ferrite and cementite.

Austenite—A solid solution of carbon.

Martensite, trootsite and sorbite—Transition forms that we will not consider.

Ferrite is carbonless iron and is highly magnetic and of low tensile strength. It is found in muck iron, all structural steels, soft steel, and especially in all steels in the annealed condition. If steel is annealed dead soft the ferrite exists there as pure carbonless iron.

Cementite is a definite compound of carbon and is found in all steels in the annealed condition. If annealed dead soft, the cementite is present as almost pure Fe_3C, and it is intensely hard. This is brought out when an annealed piece of steel is polished for microscopical examination. The ferrite, which is extremely soft, will polish away, leaving the cementite appreciably projected. If the metal is rubbed on a piece of glass when in that condition it will easily scratch the glass.

When graphite occurs in steel it is practically an error and usually develops during its working through the mill. When

steel contains 0.9 per cent. of carbon or less, it is almost impossible to develop graphitic carbon. This is a eutectic steel that contains about 6 times as much pure iron by weight as the weight of cementite. This large excess of ferrite makes it almost impossible to abuse the steel enough to drive the carbon from the combined to the graphitic state, and this grows more difficult as the carbon lowers in percentage. Above a content of 0.9 per cent. of carbon, steel has to be handled very carefully or it will develop graphitic carbon by cold working or prolonged and repeated annealing.

Pearlite is nothing more nor less than the definition given. That is, alternate layers of ferrite and cementite when steel is in the annealed condition.

Austenite is a solid solution of carbon. It is found only in those steels that are in the hardened condition. Therefore, the carbon is in a state of solid solution in the hardened condition of steel. This condition being similar to that of salt or sugar when dissolved in water. Glass is another typical example of the solid solution, the quartz, lime, soda, and the like, all being in combination. Those are all opaque substances, but when they enter into the solid solution by fusing them together, they form a transparent mass and one of the materials can be distinguished from another.

Thermal Effects of Carbon

The next step is to examine the thermal effects of carbon in steel during the processes of hardening and annealing. In this we will start with an annealed bar of steel and refer to the accompanying chart.

When we start to heat up this annealed bar of steel from the atmospheric temperature which is designated zero on the left-hand side of the chart, the temperature rises uniformly until it reaches about 1300 degrees Fahrenheit. Here the temperature ceases to rise further until certain internal conditions are satisfied. This point is represented graphically by the horizontal line and is known as Ac1, it being the first point of retardation in the hardening process of steel. This is called the first recalescent point.

When these internal conditions are satisfied the temperature again rises uniformly until it reaches about 1400 degrees Fahrenheit, where it again rests as indicated by the second horizontal line. This second recalescent point or point of retardation is known as Ac2.

After the internal conditions are again satisfied, the temperature rises uniformly to about 1550 degrees Fahrenheit, which is the third and last point of retardation or Ac3. Here, if the heat of the steel is abstracted quickly, we catch the carbon in a solid state of solution or the austenite condition. The steel will then be very hard and of great tensile strength. When we started at zero the steel consisted of ferrite and cementite, but now it is practically all austenite.

During this heating-up process the ferrite has dissolved the cementite with a consequent absorption of heat, the same as salt takes up the heat of water when dissolved therein. In other words, the cementite has disseminated itself uniformly throughout the ferrite; a condition that is only possible above Ac2. The carbon at or above this point exists no longer as cementite but as austenite.

Decalescent Points

If, instead of abstracting the heat quickly after heating the bar up to Ac3, we had allowed it to cool slowly, as in annealing, a slightly different phenomenon takes place. The temperature of the bar will fall uniformly until it reaches about 1500 degrees Fahrenheit, which, for the falling temperature has been designated Ar3. At this point, instead of the temperature falling further, or remaining stationary, it actually rises a few degrees as is indicated by the upturn in the line. The internal changes taking place here are the direct opposite of those at Ac3 and when completed, the temperature falls again uniformly to about 1350 degrees Fahrenheit, or Ar2. Here another transformation in the metal takes place and the temperature lowers again uniformly to about 1250 degrees Fahrenheit, or Ar3, where the last change takes place before it cools down to the atmospheric temperature marked zero. At zero it consists again of pure ferrite and cementite. These points are called the decalescent points, which, like recalescent, means to reglow.

Iron and Carbon in Solution

While there is some difference of opinion on this point, what in all probability does take place is that in heating the bar up to Ac1, all the carbon is in the form of Fe_3C, but at this point a partial decomposition takes place by the absorption of heat that results in the dropping of one atom of iron. This causes the rising temperature of the bar to rest until the chemical changes are completed, as it is a well known fact in chemistry that, when compounds are decomposed or disassociated, it is at the expense of heat; or in other words, heat is absorbed. The metal is then in the form Fe_2C.

As an example of this, let us refer to equation number 2. When the hydrogen is here burned to water it evolves 34,000 heat units per unit of hydrogen, and if the water were again decomposed, it would absorb the 34,000 heat units evolved as well as enough more to make up for the loss in heat that always takes place in such operations.

When the chemical changes at Ac1 are completed, the temperature rises uniformly to Ac2, where Fe_2C drops another atom of iron and becomes FeC with the corresponding absorption of heat. After this, the temperature rises again to Ac3, where the carbon becomes entirely disassociated from the iron and is in a state of solid solution, in which it will remain if quenched at this point.

Separation of Carbon

If the bar be allowed to cool slowly instead of being quenched, when Ar3 is reached the carbon comes out of solution in the iron and forms FeC, with an evolution of heat. This is similar to the chemical union of the two elements shown in equation two; with a corresponding evolution of heat.

When the chemical reactions are complete at Ar3, the temperature falls to Ar2 where the following reaction takes place. $Fe + FeC = Fe_2C$. The heat evolved from this chemical union accounts for the reglowing at this decalescent point as well as the others, and also the recalescent points.

When the separation is completed at Ar2 the temperature uniformly lowers to Ar1, and here we have the following reaction: $Fe + Fe_2C = Fe_3C$. This is the last reglowing point in the cooling down or annealing of the bar.

Allotropic Forms

Again the allotropic forms of iron must be taken into account at these critical points. There are good reasons to believe that iron can exist and does exist in three different conditions as allotropic forms. Some believe that the entire thermal phenomena at the critical points are entirely accounted for by the transformation of one of these into the other.

The three allotropic forms of iron are: alpha (α), beta (β) and gamma (γ). The alpha form is that below Ar2. Here the iron in the steel is very soft, highly magnetic and of low tensile strength. The iron in the steel between Ar2 and Ar3 takes the beta form in which it is nonmagnetic and very hard; in fact, it is so hard that some metallurgists have thought that the hardness of steel is due more to the beta iron than to the carbon. Above Ar3 the iron has been named gamma iron. It is nonmagnetic and is not so hard as beta iron, but harder than alpha.

The reasons for believing that the allotropic conditions of iron exist are: Below Ar2 iron is not a solvent for cementite, each separating from the other as in the annealed condition of steel; below Ar2 the iron is highly magnetic, while above it is nonmagnetic; steel is harder between Ar2 and Ar3 than either above or below it.

Whether the thermal phenomena at the critical points are due to chemical reacting, or to transformation in the iron, or to both, is difficult to say. That the critical points do exist there is no doubt, but the real cause of these may require further investigation.

Machining Large Boring Mill Frames

By H. A. Bertram*

How a job too large for any machine available was handled on a floor boring machine.

Interesting tool holder and method of driving the tool.

*Assistant superintendent, The John Bertram & Sons Company.

Turning the annular track for the table, and boring the taper hole for the adjustable spindle bush of large boring-mill frames, is comparatively a simple operation when machinery large enough to handle this class of work is available, but when a frame has to be machined which is too large to swing in any boring mill in the shop, the job presents complications that are most interesting to the man who has been up against work of this nature. We handled a job of this kind in the following manner:

The Method of Driving the Tool

A Niles type floor boring machine seemed to be the only tool with an unlimited capacity for turning such large diameters, but the question of getting the cutting speed slow enough had to be overcome, which was done by using the large gear ring and pinion illustrated in Fig. 1, the pinion being made to fit the spindle of the floor boring machine. This proved to be a very convenient drive, as the job could be placed in position independent of the head of the machine, and when ready, the head with the pinion on the end of the spindle could be adjusted till the pinion meshed properly in the gear.

The Tool Holder

The special toolholder shown in Fig. 4 had to be made to meet the requirements of the job; that is, a longitudinal and cross travel to the tool were necessary and it had to be operated from the outer edge of the plate. This was accomplished by means of a screw adjustment on the slide *A* and a splined rod adjustment through the miter gears to the tool slide *B*, the swivel *C* being made to fit the slide *A* and held in position by the two bolts *D* which fit in the circular slot in the slide *A*.

The Taper Boring Head

The boring of the taper hole was done

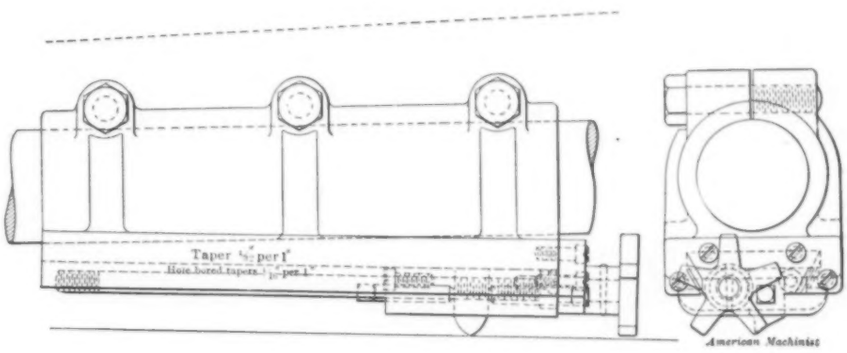
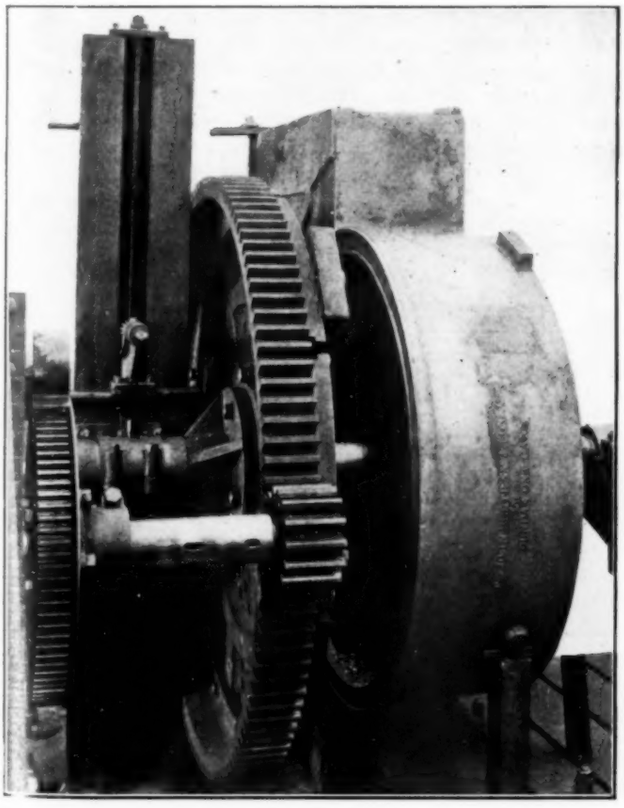


Fig. 3. Taper Boring Head



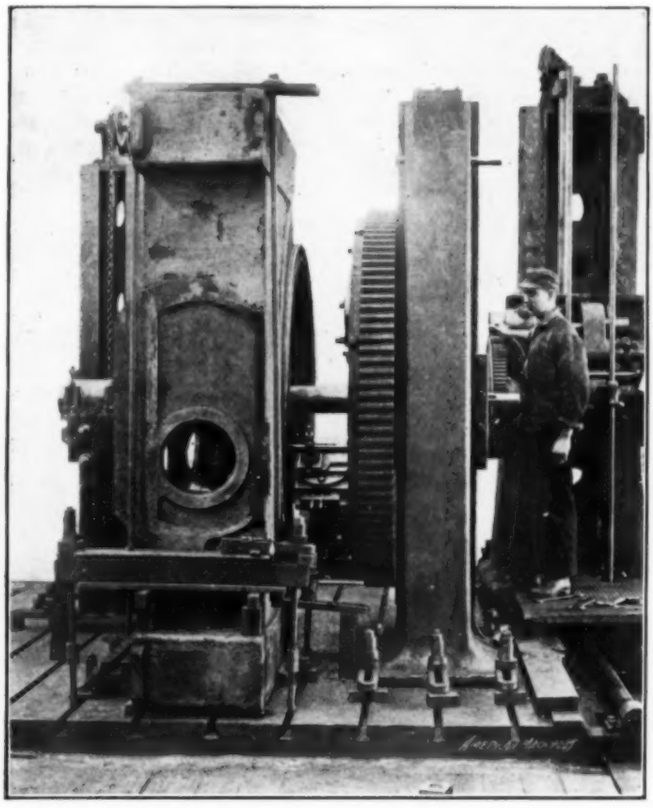


Fig. 1 Machining a Large Boring Mill Frame on a Floor Boring Machine Fig. 2

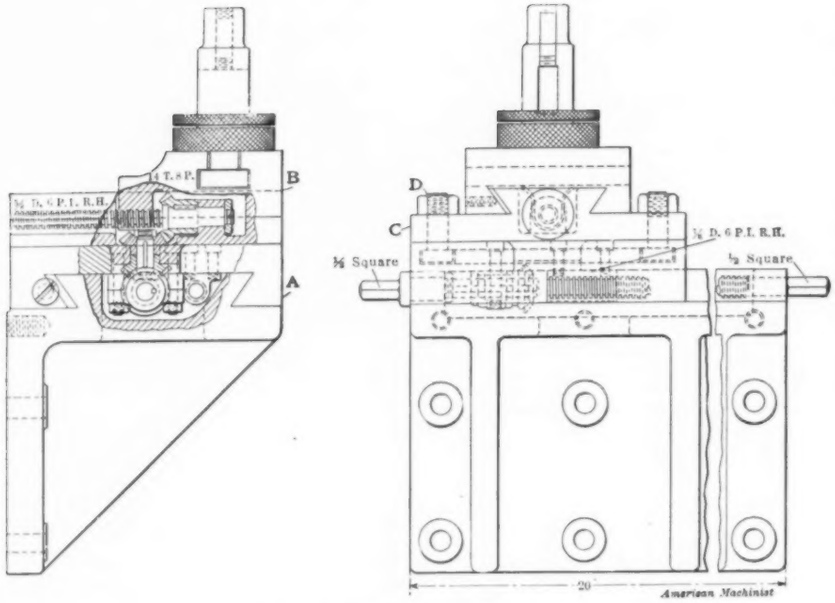


FIG. 4. THE TOOL HOLDER

by means of the head shown in Fig. 3. Care should be taken when making this head to plane the slide half the required taper in the hole. In this case we had 1/16 taper to the foot in the hole, which required only 1/32 taper to the foot on the slide for the toolholder of the head.

TURNING THE ANNULAR TRACK

In Fig. 2 is shown the toolholder in position for turning the track. The roughing of the track was done with a bush in the spindle hole of the frame to help steady the casting while taking the heavy cuts.

BORING THE TAPER HOLE

Before boring the taper hole for the spindle bush, the driving pinion was removed from the spindle of the floor boring machine, and the head was run over and connected direct to the end of the center shaft carrying the large gear, etc. This was done to enable us to get a faster cutting speed for boring the hole, and considerable time was saved in this way, the end of the shaft having been turned down beforehand to fit the nose of the spindle with this object in view. Then the center bush was removed by just knocking it along on the shaft and the taper boring head which was already on the shaft was clamped in position and the taper hole finished, after which a light cut was taken over the track. When the job was tested it showed the track true with the taper hole, and the time taken to do the work compared well with similar jobs done on a regular boring mill equipped for the work.

An Averaging Cost Card

Some of the uses of small-sized cards for keeping costs do not find it convenient to compare one lot with another, owing to the necessity for collecting a number of the small cards and securing data from each.

In order to avoid this difficulty the Fellows Gear Shaper Company, Springfield, Vt., use a 6x9 card which is made on the plan illustrated herewith. The only peculiarity of the arrangement is that it provides for six separate orders or jobs and a place for averaging them all. This is shown considerably reduced and abbreviated, but it shows the idea very clearly and enables the cost of various lots of the same piece to be very easily compared.

This form of cost card seems to be well adapted to its purpose and the experience of those using it in actual practice is very favorable.

LIST NO. NAME OF PIECE.

Order No.																					
Quantity																					
Date Started																					
Date Finished																				Average	
OPERATIONS	Man	Hrs.	Amount	Man	Hrs.	Amount	Man	Hrs.	Amount	Man	Hrs.	Amount	Man	Hrs.	Amount	Man	Hrs.	Amount	Hrs.	Amount
Turret Lathe																					
Engine Lathe																					
Universal Gndr.																					
Milling																					
Planing																					
Polishing																					
Drilling																					
Blacksmithing																					
Assembling																					
Involute Gndr.																					
Gear Cutting																					
Total Labor																					
MATERIAL	LBS.	AT																			
Total Cost of Lot																					
Cost per Piece																					

American Machinist

COST CARD FOR AVERAGING DIFFERENT LOTS

In a paper presented at the annual meeting of the Iron and Steel Institute by Gregory Tagayeff, the influence of non-homogeneity of structure on the durability of metals is admirably summarized, based upon exhaustive tests on steel rails. The author points out that data derived from the study of the chemical composition, in connection with the wear of rails, do not afford an explanation of the difference in their service. Observation of the service of rails and of other articles (shafts, axles, propeller screws, etc.) indicates that local defects have a predominant influence on their endurance. Flaws and defects observed in rails are particular evidences of non-homogeneity of their internal structure. In order to explain this properly it is necessary to call in the aid of metallography, which studies the structure of metal.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

An Interesting Punch Press Job

The sketches show a rather unique job mainly done on the press. In Fig. 1 we have the complete piece. As will be seen, it is a small formed piece of metal with a tube or shell on one end. It is essential that the shell should be within 1½ thousandths of size both in the internal and external diameters, and that there be no seam or joint in the side.

In the first place, the metal is blanked out in the press with an automatic stop feed at about 12,000 per hour, doing two per stroke, and then pierced as in Fig. 2. This could be done at the same time as the blanking, but it is found more economical to make the perforating a second operation. After this, the blank is formed, the two bends at *B B*, Fig. 1, being produced in one operation at the rate of about 1800 per hour.

The next operation is an annealing one. Here it is necessary to keep the small part of the blank hard, only softening the large end *E*, Fig. 2. For this operation a special machine was built. It consists of a wheel, Fig. 6, revolving slowly over a tank of water, cold water being supplied constantly to, and the hot water running away from the tank. The wheel is slotted across its face to take the small end of the blanks, which are placed in the slot by the operator, passed through a blow pipe and knocked off into the water and cooled, at the rate of 2500 per hour.

Following annealing the pieces are cleaned by dipping and are next drawn up by the press into a shell as at *X Y*, Fig. 3. This operation is repeated three times more, reducing the shell a slight amount each time until we get the diameter as at Fig. 4. This shows the shell after the fourth draw and when it is flattened, ready for a milling operation, which cuts off the round end and mills the shell to length as at *A*, Fig. 5, ready for a shearing operation, which cuts the side of the shell as at *B*, Fig. 5, forming lug *C*. This lug is then bent at right angles to the tube as in Fig. 1.

In the several drawing operations it is necessary to change both punches and dies very frequently to keep the shells up to size, and to save time and trouble the punches are held in the holder by a small screwed cap, as also are the dies, thus obviating the necessity of taking the tools out of the press every time a new punch or die is required. Of course, readers will understand that there are four separate drawing tools. At first, lard oil was used for drawing, and later a mixture consisting of lard oil, soft soap and a little soda was tried and found to be in every way as good for the job, and, of course, very much cheaper.

The dies were changed for every 15,000 shells, with the exception of the fourth draw, and as that determined the finished size of the shell, the die was changed for about every 5000. The drawing was accomplished at the rate of about 2500 pieces per hour.

London, Eng. C. O. MOORE.

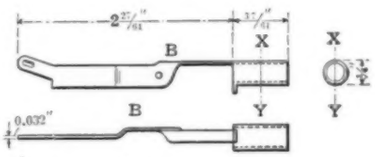


FIG. 1.

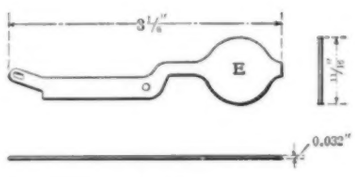


FIG. 2

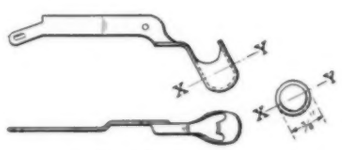


FIG. 3

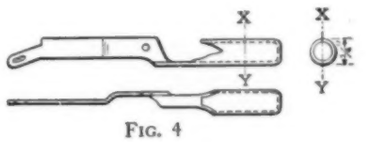


FIG. 4

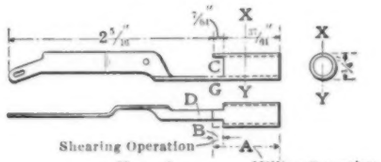


FIG. 5

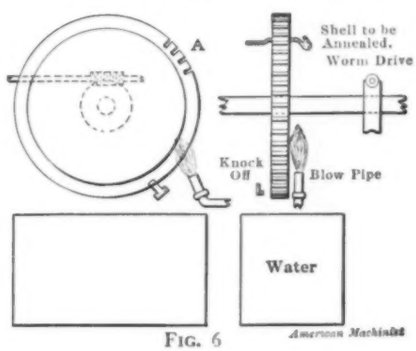
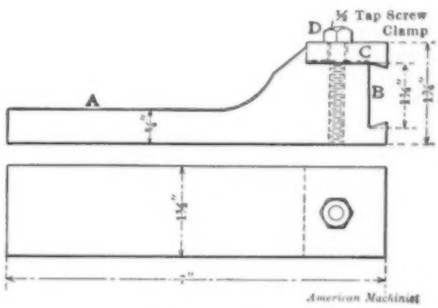


FIG. 6

THE WORK AND THE ANNEALING APPARATUS

A File Holder for the Lathe or Boring Mill

The line cut shows a file holder, which may come in handy to some of your readers. First take an old file and break it in about three or four pieces; place one in the recess *B*, teeth up, tighten the tap bolt *D* which clamps *C* tightly to the file.



A FILE HOLDER

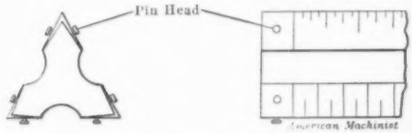
It is a time and labor saver. I have tried it out on about sixty rough gears, and forty-eight pulleys of different sizes. This device is well adapted to file up rough castings, flywheels, pipe and cast-iron rolls, pulleys, etc., both in lathe and boring mill. W. H. OSBORNE.

Philadelphia, Penn.

A Drafting Scale Protector

To a great extent the flat scale, with measuring divisions on one side, has superseded the triangular one for engineering work; yet this latter is still in continual use, and seems destined to always occupy a place in the draftsman's kit.

A triangular scale in use, rapidly wears along its six measuring faces, and in a short time the edges become irregular and worn from constant contact with the drawing-board. I have devised a simple method to keep the faces from rubbing, as shown by the accompanying sketch, which is self-explanatory. Common pins



DRAFTING SCALE PROTECTOR

are cut off about 1/16 inch from the head; pin holes are made on the faces of the scale, in the margins which are always left on the ends, and no enumerations are disfigured. The pin stubs are driven into these holes on each end. As evident, the scale rests on the pin heads, which keep the faces about 1/64 inch from the work.

This kink also can be used to advantage in the flat scale, with measuring faces on both sides. It is a great saver of scales and with proper treatment otherwise, they can be used indefinitely without the slightest erasure or disfigurement on the edges. I have wondered why the manufacturers do not provide something of this sort.

Los Angeles, Cal. L. R. W. A.

The Radial Drill in the Railroad Repair Shop

In traveling around visiting some of the most modern railroad repair shops in the country, I notice that the radial drill is not nearly as much appreciated for railroad repair work as it should be. There are many jobs which cannot be handled to advantage on anything but a radial drill. This is especially so of heavy work, which on the regular upright drill would have to be moved for each hole to be drilled. Along this line is shown in Fig. 1 an excellent illustration of the adaptability and possibilities of the plain radial drill, which is here represented in operation on a locomotive steam chest and air pump. These two jobs were not set up for the occasion, but it so happened that the pump cylinder required to be rebored before the steam chest was completed. Ordinarily, the cylinders would have been fastened closer to the column of the machine.

In many shops I have seen steam chests being bored out on a horizontal boring mill. In coring the gland holes they are not always just in the right place, and boring by this method has occupied more time than if done by the method shown herewith. If handled in the old way, these steam chests have taken apart to be rebored in a lathe or boring mill, and frequently studs are broken off, necessitating their being drilled out and renewed. In handling the work in this manner, great care is required in setting up the cylinder to insure the bore being true with the original setting, besides there are possibilities of

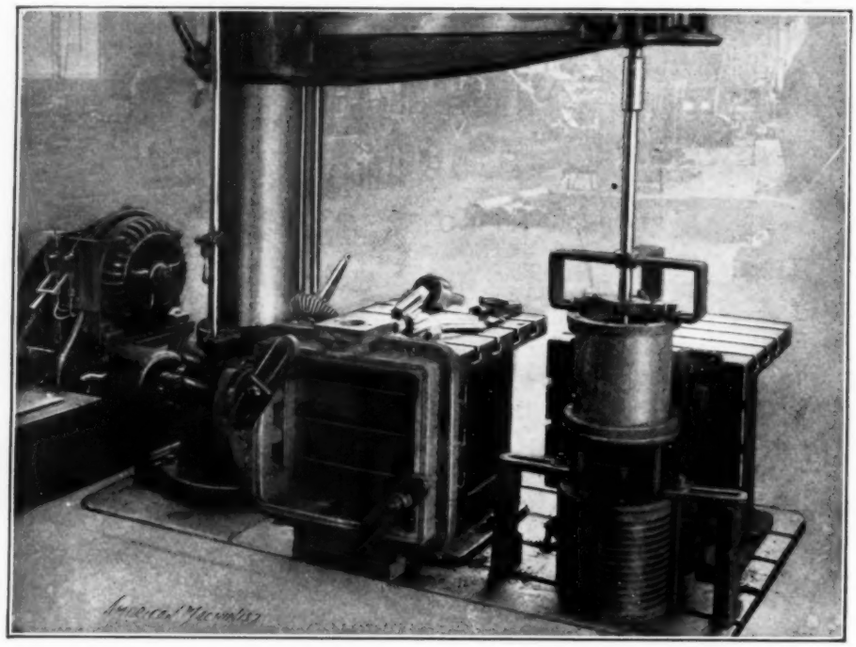


FIG. 1. REBORING AN AIR-PUMP CYLINDER UNDER THE RADIAL DRILL

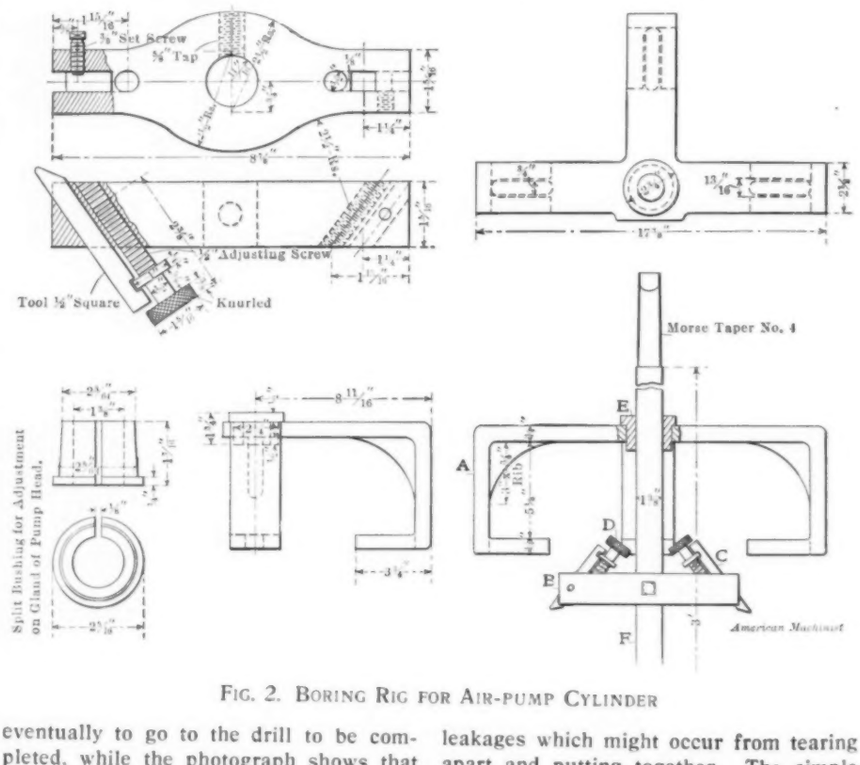


FIG. 2. BORING RIG FOR AIR-PUMP CYLINDER

eventually to go to the drill to be completed, while the photograph shows that the gland hole has been cast solid and by the special high-speed steel tools also shown, the whole job is completed on the one machine and the time greatly reduced.

I have also seen air-pump cylinders leakages which might occur from tearing apart and putting together. The simple device shown enables one to rebore these cylinders without separating them and the work can be handled by a good drill hand and done in less time than they could be taken apart and reassembled after being done in a lathe or boring mill.

The drawing, Fig. 2, shows the boring fixture more in detail with the addition recently made of an adjustment for the boring tools. In order to insure a smooth cut being taken and to prevent any tendency for the tools to chatter, the split taper bushing shown is used, this being bored a snug fit for the bar and held in the stuffing box of the cylinder by the packing nut belonging to it. An adjustment can be made just sufficient to meet the conditions.

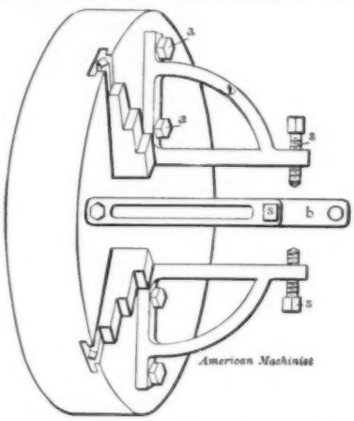
W. H. WESTBROOK.

Battle Creek, Mich.

Auxiliary Jaws for the Lathe Chuck

Every machinist knows what a bother it is to chuck a rough bushing in the lathe so that both ends will run true. We got tired of this trouble in our shop and fixed up the rig, shown in the sketch, which saves time and temper. An apprentice now does the work that before required a machinist.

On almost all lathe chucks there is a slot or T-groove between each two chuck



AUXILIARY JAWS FOR THE LATHE CHUCK

jaws for the purpose of running bolts through to clamp work to the chuck and where these slots are absent, holes can be drilled to hold the bolts *a* for the braces described below.

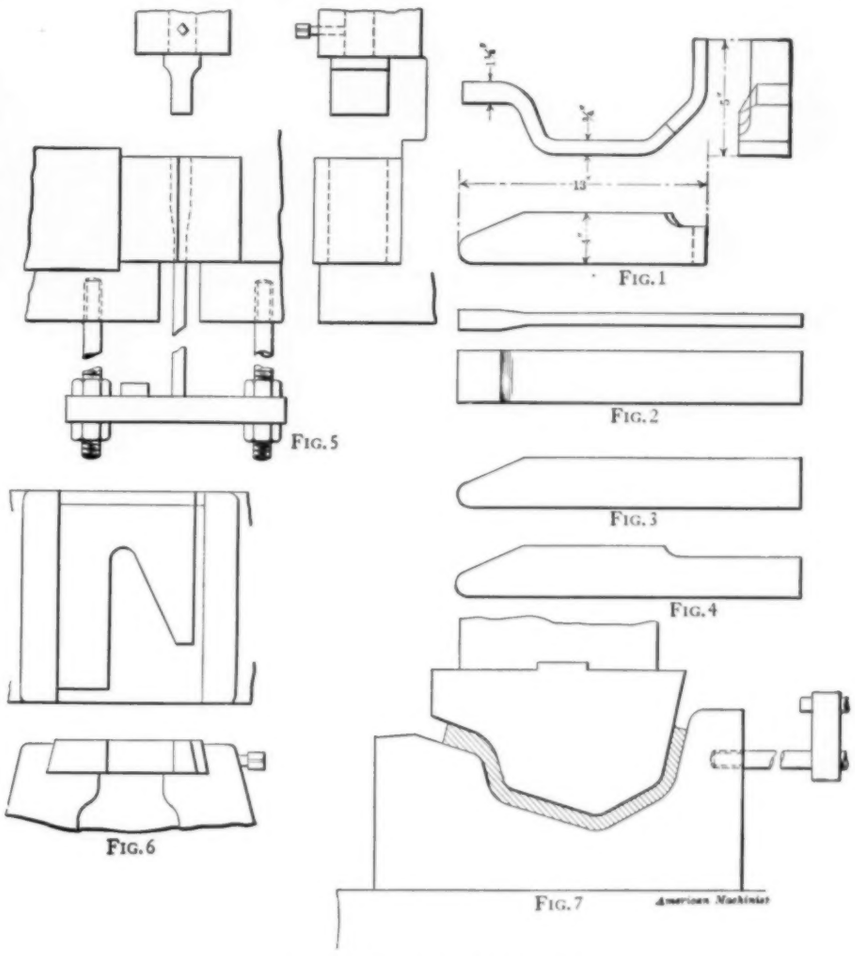
Four braces are cast or forged of a size suitable for the chuck used, and shaped like the ones at *b*. They are drilled and tapped at their outer ends for set screws of a size suited to the work, and their backs are drilled for the bolts which clamp them to the chuck.

When you are ready to bore the bushing, chuck it, and true up the end in the chuck. Then clamp the braces on the chuck, screw the set screws at *s* down against the bushings and true up the outer end by adjusting the set screws in the same manner as with the chuck jaws. You can get them true this way considerably quicker than in the old way and there is no danger of their being knocked out of true again by the tool catching.

Baltimore, Md. F. E. FICK.

Making a Steel Bracket in Four Operations

Fig. 1 shows the finished bracket and Figs. 2, 3 and 4 show the various operations. These brackets were made to replace a large quantity of malleable-iron castings, which had been found worthless for their purpose. The function of these brackets was to carry the Westinghouse magnetic brake, as applied to ordinary street cars, and they had to stand severe shock. As there was no time to have others cast, a forging



THE BRACKET AND THE DIES

was decided upon. This forging was reduced to its simplest form, both from the blacksmith's standpoint and for the work required of it so that it could be made accurately and cheaply.

Three sets of inexpensive tools were made, which completely covered all the operations necessary, unskilled labor being used throughout. As will be noticed, one end of the bracket is thickened up from ¾ to 1⅛ inches. A bar ¾x4 inches was selected for this job. The end was staved up to 1⅛ inch for a distance of about 3 inches. This was done on the Acme bolt header by the dies shown in Fig. 5. The bar was not only gripped between the dies, but also backed up by screws and plate, as shown. This was a hard job and had to be done in two successive steps; that is, after the bar had been partly staved up it was pushed forward again to receive the finishing blows, a filling-in piece being inserted at the outer end for backing up.

This operation finished, the staved end was reheated and trimmed in the die, Fig. 6, to the shape shown in Fig. 3, under a regular shearing and punching press. This die also sliced the other end into shape.

The bending operation was the simplest of all and brought the piece, which was anything but pretty by this time, to look clean and shapely. Fig. 7 shows the bending dies which accomplished this; the bracket is shown between them, as it would be at the end of the operation. The bending dies were made of cast iron and were operated in a 50-ton hydraulic press. The die was designed so as to produce a balance of pressure on the bracket.

The angle to which it is set accomplishes this. This job was a money saver, as compared to a forging which would have been made from a bar 4x18 inches, the reduction being made by the power hammer.

This was a simple piece of work, the method of doing the work being the all important part. When gone about in the right way it represents an enormous gain.

Cincinnati, O. P. SANDIESON.

Punching a Curved Slot

It often happens when designing dies or punches that it is a matter of economy to make the nose of the punch of steel and the remainder of cast iron. A knowledge of the different methods of fastening these steel noses to the die or punch can usually be obtained only through actual experience, but when it is once acquired, it is worth money both to the designer and his employer. The sketches illustrate a scheme that was successfully employed recently by a company with which I was at the time connected, and may be of interest to some reader of the AMERICAN MACHINIST:

It was necessary to design a tool to punch a curved slot 5/16 inch wide and of about the length and shape shown in Fig. 1, in a steel plate about 9 feet long, 2 feet wide and ¼ inch thick. After considering several plans, a construction similar to that shown in Fig. 2 was decided upon. The body is of cast iron, having a punch made of hardened-steel plate fastened to it by means of screws.

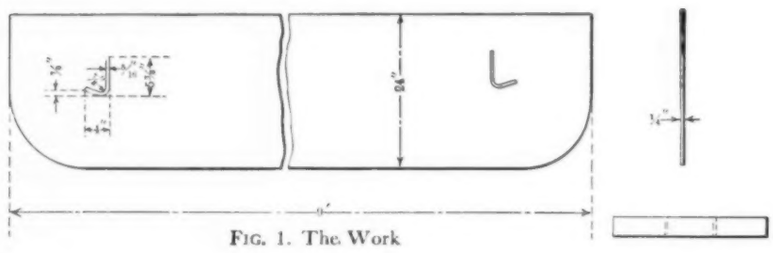
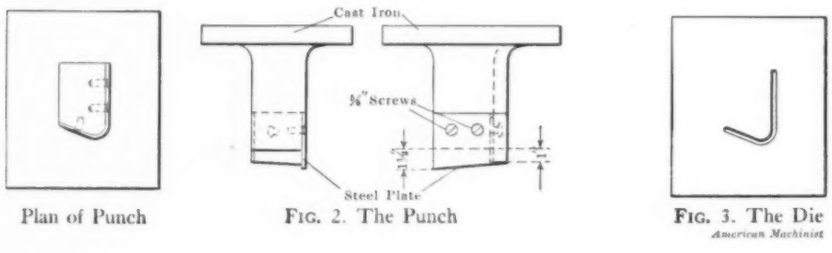


FIG. 1. The Work



Plan of Punch FIG. 2. The Punch FIG. 3. The Die

American Machinist

TOOLS FOR PUNCHING A CURVED SLOT

The cast-iron block is the same contour and size on two sides as the outside of the slot to be punched, the other two sides being straight. For a distance of 3 or 4 inches from the end or bottom, the casting is offset to a depth equal to the width of the slot, thus forming a shoulder 5/16 inch high. Then a 5/16-inch hardened-steel plate is bent around the offset part of the body and fastened with ⅝-inch machine screws. It fits close up against the shoulder and so relieves the screws of practically all of the shearing strain, so that about three screws are all that are necessary for a punch of this size. The plate extends beyond the casting about an inch at one end and an inch and a half at the other, as shown. This provides for about a half-inch slope along the cutting edge, thus causing the steel plate to be sheared away gradually. The bottom die shown in Fig. 3 is simply an ordinary steel block with a slot in it the shape of the slot to be punched. The slot in this die is 1/32 inch wider than the punch, thus allowing a clearance of 1/64 inch all around.

This is a very good set of tools, because if the punch is broken a new one can be put on without making a whole new casting. Beside being easily repaired, the first cost is reduced, because it is not necessary to make and finish a large steel block as it would be if the tools were made entirely of that material.

Scranton, Penn. S. HURLEY.

Planing a Casting with Concave Face

The accompanying sketches illustrate a planing operation which, while perhaps not new to many readers, will, I have no doubt, prove interesting to some. The casting to be planed may be seen on the table, Fig. 1. There were about two dozen of these castings, and they were machined all over, and buffed to a mirror-like polish on the curved surface.

All castings were faced on the base

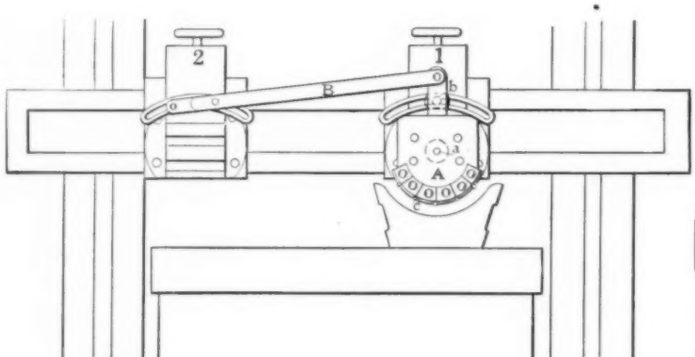


FIG. 1

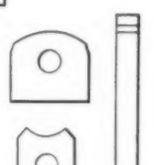


FIG. 2

American Machinist

THE PLANER RIG AND TOOLS

first, on the large slab miller. A special planer tool holder was made, having recesses for five tools, as shown at *A*, the arm projecting about 12 inches from the body giving considerable leverage and allowing the head to be kept fairly tight. The clamping studs of head No. 1 were replaced by stud *b* in the center, giving the maximum swing desired for the finishing tool. A small hole was drilled immediately opposite the center pin of the tool block (not the head) for locating the tool holders. The holder was clamped by the four bolts. By using the center pin of the tool block it was possible to regulate the depth of cut without altering the radius.

Head No. 1, after being set central, was clamped to the cross rail and a small stop was placed at one end, the bar *B* connecting the two heads. As head No. 2 was moved, head No. 1 rotated about the center *a* on a radius equal to that of the casting. The tools were ground to the standard shape, and by using the locating pin *a* in the holder the points were touched on the emery wheel to give the correct radius.

There being fine tools, it did not take long to machine the large concave surface. The smaller curves were roughed by a single tool in the holder and finished with a broad-nosed tool. The stop being set on one side, the head could be moved away to finish the smaller radius and returned to a central position again

without any bother. The stop was then changed to the opposite side of the head for the other small radius.

A special holder, Fig. 2, was made for finishing. The finishing tools for the smaller radius was ground to slightly larger radius than desired, to reduce the cut without interfering with the true form very much, and for the larger radius it was slightly smaller. The speed of the platen was reduced, and we obtained a very smooth finish. The stop was again used for finishing, with the head always in central position.

Toronto, Can. J. E. HAILSTONE.

How a Small Shop Made Good

A short time ago, an iron construction company was erecting a large plant in our vicinity, and had on the job a carload of shafts 3 inches in diameter by 21 feet long. On one end a United States standard thread should have been cut, but was omitted through some misunderstanding. To use them without the thread was impossible, unless a change that was not practicable was made in the design. To send them back to their original shipping point was too expensive. Therefore it was decided to have the thread cut in town.

Locally, there was only one large fac-

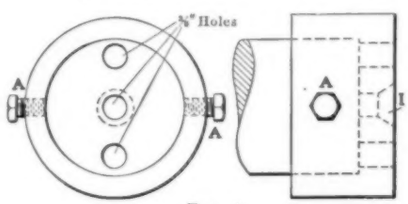


FIG. 1

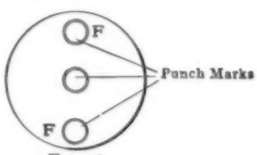


FIG. 2

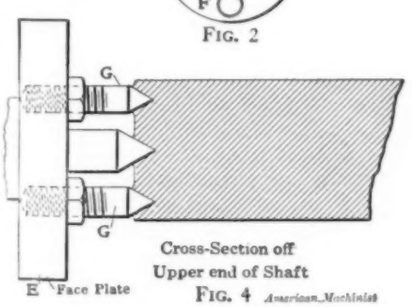


FIG. 4 American Machinist

DETAILS OF LATHE RIGGING

tory with proper facilities for handling this particular length of shafts and thinking they had a corner on the job they made their bid rather high. They did not, however, have a thread-cutting machine of the proper capacity and accordingly had to do the work on their large lathe. This meant that the shafts had to be centered on the ends and drilled and countersunk by hand.

Our shop being equipped for small work only, our largest lathe was only 6 feet long. By some simple rigging we thought we could handle the 21-foot shafts and therefore put in a bid for the job at a considerably lower figure than theirs. It was only by stepping aside from the ordinary routine of doing such work that we were able to compete.

We omitted the many operations of centering, drilling and countersinking the shaft ends for the lathe centers, and thereby saved much time and hard labor. Instead we made a templet, as shown in Fig. 1, with 3 holes ⅝ inch in diameter. This was made to slip over the end of the shafts and clamp with the set screws *A A*. Then a prick punch was turned up to fit the ⅜-inch holes in the templet. With this we prick-punched now by hitting upper end of punch with the center of the shafts and also two places near the rim, as shown in the end view of shaft, Fig. 2.

These marks were made deeper and larger with a heavier center punch and hammer, and saved drilling and countersinking the center. Of course, it burred the end of the shaft, but in this particular case it was good enough, as it did not matter how the end appeared, as long as a good thread was cut to take a nut properly.

In Fig. 3 is shown the 21-foot shaft in the 6-foot lathe ready for cutting the thread. We took the tailstock off and secured it to an ordinary work bench, placed at the proper distance and lined it up with the lathe-head center as shown at *B*. The steadyrest *C* was then placed at the extreme end of the lathe bed. To further steady the shafts, we took an ordinary wooden horse and built on it two half bearings of hardwood. The top half was hinged, so we could throw it back the same as an ordinary steadyrest and when holding a shaft it was locked with a bolt. This we placed half way between steady rest *C* and tailstock *B* as shown at *D*.

Not being able to move the apron to the tailstock it was necessary to cut the thread on the end nearest the lathe head. Consequently, an ordinary lathe dog would be in the way if used to revolve the shaft. We therefore secured two ½-inch set screws, with tapered ends *G*, in face plate *E*, as shown in Fig. 4. These tapered ends *G G* fitted into the punch marks in the shaft ends shown at *F F*, Fig. 2. This arrangement of revolving the shaft, is on the same principle as an ordinary spur center used for turning wood.

A substitute for a drilled and countersunk center at the back end of the shaft is shown at *H*, Fig. 3. The templet that we had previously used for locating the center, and punch marks *F F*, Fig. 2, we here used as a *false* center. It was simply slipped over the shaft, and secured with the two set screws *A A*. Having a countersunk center *I*, Fig. 1, it fitted the center in the tailstock.

By cutting a groove in the shaft at *J*, Fig. 3, for threading tool clearance, and using a temporary tackle to lift the shaft in place, we were able to do the job, and secured the contract against our apparent odds of poor facilities.

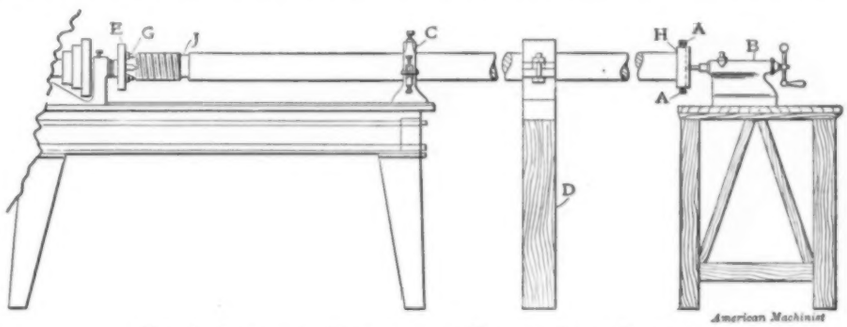
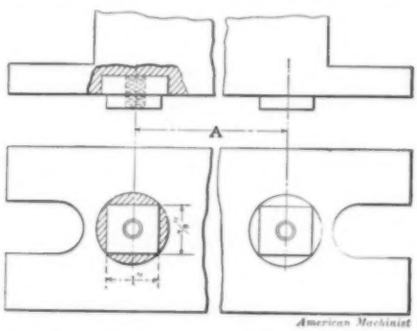


FIG. 3. LATHE AS RIGGED UP TO THREAD LONG SHAFTS

Bayonne, N. J. J. A. LUTHER.

Locating Tongues for Fixtures

The sketch illustrates a simple method I have adopted for locating fixtures on machine tables, which adds to their use-



LOCATING TONGUES FOR FIXTURES

fulness as they can be used on tables having different widths of T-slots. The sketch shows an arrangement suitable for ⅝- and 1-inch slots. The holes require to be accurately drilled, the plugs being put in a snug fit. The tapped hole through the center allows for a set screw being used for removing.

Belfast, Ireland. T. E. RAY.

Discussion of Previous Question

Desirability of Model Machines

Under the above heading I noticed the suggestion of J. M. Williams on page 533, for the making of model machines in quantities for experimental purposes. The two examples he gives are in my opinion rather unfortunate. Probably model machines would be suitable in some cases, particularly where the machine does not have to handle such material as fiber or yarn which must be the same whether worked on a full-sized machine or on a model.

The working man, with a family, who begins experimenting is likely to lose all his savings, and he would be foolish to begin at all without seeing an exceedingly good chance of completing the experiments quickly and cheaply, and successfully marketing the article or securing a moneyed partner. As Mr. Williams seems to be interested in looms, I should like to point out that a number of parts in a loom are made at a very cheap rate in standard sizes and would cost many times more if made in the model size, owing to the limited sale.

Probably the best thing for a working man to do if he wants to experiment with a loom at home is to buy a narrow one second hand. As Mr. Williams mentions a warp-stop motion as an example, he may be interested to know that my father invented what was probably the first commercially successful one. He was before his time, however, and only got it adopted to a very limited extent, as there was no automatic loom at that time to make a stop motion absolutely essential. This particular invention just about cleared expenses. He was in the position indicated by Mr. Williams, except that he had a small business of his own. When he wanted to experiment, he simply bought an old loom for about £2 ($10) and installed it in the attic and worked at it in the evenings. (We, the family, had to get accustomed to the artificial thunder up aloft.)

Old looms fully equipped, but shaky and dirty, can easily be obtained here from 30s. to 50s. ($7.50 to $12). We have one in our place which only cost 30s. ($7.50) and it has been used for a considerable amount of experimenting.

I have no doubt spinning machinery will be cheap enough second hand and probably it would be cheaper in most cases to get an old frame cut down to a few spindles in length than to make a model.

Although I am continually experimenting, I do not see how models would help

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

in any line I have touched, and cannot imagine an instance where a sufficient trade could be done in model machines to warrant any firm going to the expense of making same in quantities. A much more useful convenience would be a public record for each class of inventions if a sufficient proportion of inventors could be persuaded to give a report about each of their inventions.

This would save many workmen from spending their money at all on hopeless tasks.

Bradford, Eng. HAROLD SMITH.

Your correspondent on this subject on page 533 surely has not considered the wide range of machines a modelmaker would have to put on the market in order to meet the demands of would-be inventors. It has to be remembered that model machines are made in various forms; that is, perfect-scale models, working models, and what are sometimes called skeleton models. They are usually made of wood with metal bearings, etc.

Scale models are very often unsuitable as it is usually some detail which it is intended to improve and it would be too small and fragile to perform the required operation.

Working models would likely be so altered in their proportions, etc., that it would be found impossible to add the desired improvement, and skeleton models are usually, shall I say, built around the invention.

After fully eight years' experience in the model-making line, I may say that I have found that inventor's models are usually most satisfactory if made full size. During that time I have not been engaged on two models that were alike. They have varied from a golf club to a full-size forced draft furnace front, and from a machine for making articles to take the place of hat pins to an automobile engine.

In conclusion, I would add that there are many inventors in the same position as your correspondent, as a common would-be customer to the modelmaker is the man who is going to pay for his model from the profits earned by his invention; but, of course, modelmakers know how small a proportion of inventions ever earn any profit.

ANDREW TAIT.

Edinburgh, Scotland.

Placing Concrete in Freezing Weather

On page 912 is an article under the above title which is a trifle loose for the amateur to read. The literature on the subject is very large and more exact information should have been given by the author.

Salt lowers the freezing point about 1.02 degrees for 1 per cent. by weight of salt added to water. More than 10 per cent. of salt added to the water weakens the concrete. The rule for adding salt is to add 1 per cent. by weight of salt to the mixing water for every degree of temperature below 32 degrees Fahrenheit, but limit the amount to 10 per cent. The amount is ascertained as follows: Freezing point is 32 degrees Fahrenheit and it is proposed to put in concrete at a time when it is believed the temperature will fall to 20 degrees Fahrenheit before the final set is obtained. Then 32 — 20 = 12 degrees, which means that 12 per cent. (by weight) of salt must be added to the mixing water and thoroughly dissolved before the water is used. As this exceeds a conservative limit, some other means must be sought when the temperature falls so low. Salt, being efflorescent as well as deliquescent, appears on the surface in damp weather.

The writer, from an extended experience, concludes that moderate heat is the best protection *when it is absolutely necessary* that the work be done in freezing weather. Run a perforated steam pipe, or grating of such pipes under the sand and stone piles so that the steam will be constantly going through and prevent the formation of ice crystals. Run a steam pipe into the water barrel to keep the water warm, and run one into the drum of the mixer. If the sand, stone or water are so hot as to be uncomfortable to the hand, they will hurt the cement. Clean the surface of the set concrete with steam under at least 60-pound pressure and warm the forms with it in advance of the pouring. It is a good plan to nail building paper on the outside of the studding to form a air space. Heat makes concrete set quickly, and in setting a considerable amount

of heat is naturally generated. If the temperature of the fresh concrete can be kept above 32 degrees Fahrenheit for three hours, all danger is over. In cold weather, use less water than in summer.

For average weather conditions the writer has used for years a rule original with himself for gaging the water, and it is merely that the weight of the water shall equal the weight of the cement.

For a small job, use two lengths of old smoke stack laid on the ground in V-shape and at the point of the V place over the pipes a galvanized-iron tank or box about the size of a barrel. This is the water barrel under which a fire of scrap wood is built and pushed through the sections of pipe. These sections are always hot and the sand is warmed over one while the stone is warmed over the other. A chimney on the far end will increase the draft and the pipes may be kept as hot as desired.

ERNEST MCCULLOUGH.

Evanston, Ill.

The Error of Incorrect Setting of a Slide Rule

Con Wise, in his article on "Logarithms on a Desert Island," page 487, shows an interesting, although probably useless, method for finding approximately the logarithms of nu bers. At the end he states that work done in the early part of the scale of a slide rule is about ten times as accurate as at the other end, and seems to base his argument on the difference of slope at either end of the graph representing logarithms of numbers. Such a statement is extremely vague, but I guessed he meant that a slight error in setting the slide made at the right-hand end gave an error in the answer ten times as great as that caused by a similar mistake at the other end. Being skeptical, I made some interesting calculations, which show the percentage of error in an answer, which would result in different positions on the rule, from an error in setting the cursor. Anyone slightly acquainted with mathematics will know that for true comparisons, we must base everything on percentages.

To show my method clearly, I must first mention the principle of the slide rule. If we wish to multiply numbers, we can do so by adding together their respective logarithms and finding the number, or antilogarithm, corresponding to this total logarithm. A slide rule does this mechanically by adding lengths which are proportional to the logarithms of the numbers to be multiplied. The two bottom scales are graduated in such a way that the distance of any number from the end is proportional to the logarithm of that number. Thus logarithm 4 = 0.6021, and the distance from end to division 4 is 0.6021 of total length of scale. Number 1, whose logarithm = 0.000, is therefore the commencement of the scale, and 10, whose logarithm = 1, is at the other end. The length of the 10-inch pattern rule is 250 mm. Now suppose, in setting, an error is made, the cursor being placed 1 mm. to the right of the correct position. Compare the effect on the answer for readings near each end, and in the center of the rule. The whole length of scale representing a logarithm, and equal to 1, this error of 1 mm. of length in 250 mm. will give an error in the logarithm of a number at any place of $1/250 \times 1 = 0.004$. At a position 5 mm. from the left-hand end, the logarithm $= 5/250 \times 1 = 0.02$, and its corresponding number or antilogarithm, as shown by the divisions graduated on the scale, is 1.04713. If, by mistake, the reading is taken 6 mm. from the end, or 1 mm. in error as regards distance along the scale, the logarithm will be increased by 0.004, as shown above. Thus, the incorrect logarithm will be $0.02 + 0.004 = 0.024$, and the number which would be read on the scale will be the antilogarithm of $0.024 = 1.05682$. So the actual error in the answer due to an error in setting of 1 mm. at this position equals $1.05682 - 1.04713 = 0.00969$.

$$\text{or } \frac{0.00969}{1.04713} \times 100 = 0.926 \textit{ per cent.}$$

Similarly, at a distance of 125 mm., the center of the scale, the logarithm $= \frac{125}{250} \times 1 = 0.5$, and its corresponding number is 3.16228. Again, an error of 1 mm. would increase the logarithm by 0.004, giving 0.504, whose antilogarithm or number is 3.19154. Here the difference is 0.02926 in 3.16228

$$\text{or} = \frac{0.02926}{3.16228} \times 100 = 0.926 \textit{ per cent.}$$

At the right-hand end, 245 mm. from beginning, the logarithm is $\frac{245}{250} \times 1 = 0.98$, and its number is 9.54993.

At 246 mm. the logarithm again increases by 0.004, giving 0.984, whose number is 9.63829. Here the difference is 0.08836 in 9.54993, or 0.926 per cent.

It is seen that an error of 1 mm. in length in setting the scale at either of these three positions makes the same percentage alteration from a correct reading, and so explodes the theory that there is greater accuracy at one end than at the other.

It also shows that to get an answer 1 per cent wrong, the total errors in the same direction must amount to over 1 mm. on a 10-inch rule, or 1/250 of the length of any rule. The errors in setting being about the same for any length of rule, the longer ones will be more accurate for working, though a 10-inch rule is sufficiently accurate for all practical purposes.

Manchester, Eng. E. M. SENYOUR.

Making Lathe Lead Screws

I have made screws, by nearly the same method described by Mr. Mulvey on page 719, up to 48 ft. long by 6 inches diameter.

Mr. Mulvey says he gets his rough stock 1/16 inch above the size of the screw he has got to make. I don't think he has anything to gain by that. In a screw 24 feet long the time that would be spent in straightening it would pay for the extra metal required if he got ⅛ or 3/16 inch extra to take off. I take a bar of mild steed from the cutting-off machine centered and cut to length and ⅛ inch over size of finished screw. It is straightened if necessary by a screw jack in about 10 or 15 minutes. I then turn the end to fit a bronze bush which has got to follow the roughing out tool. Using two tools, front tool for roughing and back tool for finish, taking a finishing cut 1/64 inch. After that I put a square-nose tool in and rough to within 0.007 inch of the bottom of the thread. Then the sides of the threads are roughed out, using both tools, each tool cutting one side only. We put the screw to one side for about a week to get cold and season. After that we straighten it, finish the bottom of thread, finish the sides with a high-speed tool, doing one side at a time, oilstone the tool well and then there won't be any trouble filing marks out. I have seen a screw 10 feet long, 2 inches diameter, ½-inch pitch English thread done, and a first class job, in 10 to 11 hours.

Birmingham, England. G. W. B.

Forced Lubrication

In a paper presented before the Institution of Automobile Engineers, by R. K. Morcom, dealing with forced lubrication, it was pointed out, in connection with the importance of the oil film, that the resistance of a fully lubricated surface might be only 1 per cent. of a similarly loaded surface in which an oil film was not maintained. Resistance to shearing depended upon the viscosity of the lubricant, thickness of the film, and the area of film in shear. The temperature of the film might alter its viscosity; the extent of the film might not be equal to the extent of the bearing; the thickness of the film might not be such as entirely to prevent abrasion, and the clearance in the bearing might be irregularly distributed and inaccurate, and similar disturbances might be created by bad alinement of the shaft or its springiness, so that it was not possible to solve the problem entirely.

Foundrymen's Convention at Detroit

Editorial Correspondence

A convention voted the most successful in the history of the association.

A number of instructive papers presented dealing with the various problems of foundry practice.

The most successful foundrymen's convention that was ever held, both in point of numbers present and machinery and supplies exhibited, was held from June 6 to 10 in Detroit, Mich.

This was the fifteenth annual convention of the American Foundrymen's Association, and with them met the American Brass Foundrymen's Association, the Foundry and Manufacturers' Supply Association and the Foundry Foremen's Association. Over 2000 were registered at the convention, and the exhibition of foundry machinery in operation filled two large buildings and a tent at the Michigan State fair grounds. The clerical work was performed and the business meetings, at which the numerous papers were read, were held in another building that was admirably suited for this purpose.

Among the important business transactions that took place was to petition President Taft to appoint Joseph A. Holmes, of Detroit, as Director of Mines. Mr. Holmes has done much valuable work for the foundrymen's associations and this action was taken in appreciation of his services. Another important motion that was passed was to coöperate with the Society for Testing Materials and the National Bureau of Standards to formulate a set of standard specifications for the nonferrous alloys.

Program of Papers

The first paper was "Fluxes as applied to the Brass Foundry," by Erwin S. Sperry, Bridgeport, Conn. In this he showed that common salt was the best flux that could be used, although in some cases charcoal was a good thing to use. The discussion brought out the fact that the coarse unpurified salt was better than the ground and refined table salt. H. M. Lane, of Cleveland, Ohio, gave a paper on the "Use of Magnesium in Deoxidizing Aluminum Alloys." The results of numerous tests that had been made were given in detail and the fractured test bars were exhibited.

A paper to be given with lantern slides on "The Permanent Mold," by Edgar A. Custer, Philadelphia, Penn., could not be given, owing to Mr. Custer's being sick, but it will be printed in the proceedings. Other papers at this session were "Foundry Efficiency," by Benjamin D. Fuller, Cleveland, Ohio, and "The Personal Equation in Accidents, by Thomas D. West, Cleveland, Ohio.

At the Wednesday morning session an "Address on Brass Foundry Practice" was given by Jesse L. Jones, Pittsburg, Penn., and "Electric Power Required to Melt Brass, Bronze, etc.," by Prof. J. W. Richards, South Bethlehem, Penn., was the second paper in the brass foundrymen's part of the meeting. In this latter he showed that only from 5 to 10 per cent. of the heat energy of the fuel was gotten into the metal in melting brass in a crucible; from 15 to 25 per cent. is thus utilized if a regenerative furnace is used and from 25 to 40 per cent. if the metal is melted in a cupola. With electricity, however, an average of 75 per cent. of the heat energy goes directly into the metal to melt it down.

In the iron session a paper on the "Physics of Cast Iron" was read by Henry M. Lane and the report of the committee on chemical standards for iron castings was presented by Dr. J. J. Porter, of Cincinnati, Ohio; while it is called a committee report, Dr. Porter was the committee of one. This is the most elaborate report, or paper, that has been presented to the association and it will occupy something over 300 pages of the proceedings. It is a very complete treatise on cast iron and gives the effect of the different ingredients that are in or are put into cast iron. The grain structure, porosity, shrinkage, blow-holes, fluidity and various other things of which a knowledge is essential in manufacturing iron castings have been investigated and the resultant data given. The chemical compositions for making 83 different kinds of castings, for as many uses, are given and a directory and analysis of all of the brands of pig iron in the United States are given. This report will probably be put into book form later.

On Wednesday afternoon a boat excursion on the Detroit river was enjoyed by the convention and in the evening the same boat was chartered for a moonlight excursion.

At the Thursday forenoon session the papers were as follows: "The Value of the Association to its Members," by Frank F. F. Stephenson, Detroit, Mich.; "Cooperative Courses in Metallurgy," by Dr. J. J. Porter, Cincinnati, Ohio; "The Shockless Jarring Machine," by Wilfred Lewis, Philadelphia, Penn.; "Rejected Castings in Steel Foundries," by S. D. J. Emerson, New York City; "Reward, Premium or Bonus," by W. J. Power, New York City; and "Report of Committee on Industrial Education," by P. Kreuzpointner, Altoona, Penn.

On Thursday afternoon the papers were: "Modern Foundry Practice," by Charles F. Bragg, Mansfield, Ohio; "Mounting Patterns on Molding Machines," by Hugh McPhee, Tarrytown, N. Y.; "Electric Furnaces for Melting Nonferrous Alloys," by A. I. Marsh, Detroit, Mich.; "Overhead Transportation for the Foundry," by A. W. Moyer, Philadelphia, Penn.; "The Electric Furnace," by H. M. Lane, Cleveland, Ohio; "Foundry Transportation Methods," by David Gaeher, Cleveland, Ohio; "Suggested Specifications for Foundry Coke," by Dr. R. Moldenke, Watchung, N. J.; "Analysis of Lead in Brass Alloys," by C. P. Karr, New York City; and "Cost and Cost System Applied," by C. R. Stevenson, New York City.

Exhibits Shown

In the machinery exhibit probably every manufacturer of molding machines and foundry supplies in the United States was represented. The silver cup that was presented by the Penton Publishing Company for the best working exhibit was won by the Tabor Manufacturing Company, of Philadelphia, Penn. There were 85 exhibitors, of whom 12 were molding-machine manufacturers that probably used one-half of the available floor space. Cranes were shown in operation, lifting and turning over molds that were 4 feet deep and 6 feet square. A Cutler-Hammer lifting magnet was shown lifting over a ton of pig iron. Melting furnaces were shown in operation. The Oliver Machinery Company, of Grand Rapids, Mich., exhibited its full line of pattern-making machinery. Wm. Sellers & Co., Philadelphia, Penn., had one of its automatic drill grinders, as well as a sand mixer, in operation. The Carborundum Company showed its products. Besides these several manufacturers and supply houses exhibited their cupolas, blowers, fans, crucibles, flasks, match plates, foundry wheelbarrows and shovels, steel barrels, automatic and ordinary riddles, as well as all kinds of molders' small tools, sand blasting machinery, sprue cutters, air rammers, molding and core-sand mixers, tumblers, air and electric hoists, trolley systems, air compressors, core-making machines, core ovens, compounds, facings, partings, ferro-alloys and ingot and pig metals of all kinds, fluxes, sands, fire clay and bricks, oil burners, torches, ladle heater, mold driers, etc. In fact, everything that would be needed to thoroughly equip and run a foundry casting any kind of metal could be ordered from samples that were shown at the exhibition.

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American Machinist

Editorial

Cancelation of Machine Tool Orders

On pages 1077, 1078, we abstracted three papers presented at the recent convention of the National Association of Machine Tool Builders, dealing with the question of cancelation of machine tool orders. These addresses and the attendant discussion mark the beginning of a movement to raise the machine-tool building industry to a higher business level. We believe that this movement will earn its well merited success.

There is but little need to discuss either the evils that arise from the cancelation of orders, or the benefits that would accrue provided this cancelation were done away with. The important point to look for is the cause; this cause is *speculating in orders.*

The machine-tool user speculates with the orders that he gives the salesmen. He may over-estimate the growth of his business, his need of machinery, and take entirely unwarranted chances knowing that the habit of the trade in accepting cancelations will free him from financial difficulties if he does not want the tools when they are ready for delivery.

The salesman, or dealer's agent, is ready to speculate in orders, to urge the buying of more tools than the customer needs, using the argument of prosperous times, long deliveries and the like, and either writing into the order, or agreeing that when the time of delivery comes a cancelation can be easily made if desired.

The dealer in turn accepts the orders brought in by his salesmen and passes them along to the manufacturer, with the addition of orders for stock. In these latter he may speculate on the condition of business in general, on the condition of business in his locality and on the needs of his customers.

To all these, and based upon them, the manufacturer adds his estimates of needs for his own stock. He plans his shop equipment and his organization to handle this volume of book orders. In this way he is compelled to speculate with his own business.

The effect of all this is cumulative, with the manufacturer at the end of the whip line.

These speculative elements must be removed from the machine-tool building industry, and until they are removed, the business will never be upon the sound basis that it deserves.

Turning to the economic side for a moment, there are the usual increases in cost that go hand in hand with speculation of any kind. The manufacturer fixes the prices of machine tools upon his costs for material, labor and expense. If his books are filled and overflowing with orders for future delivery, he is compelled to order large quantities of raw material in the nature of pig iron, bar stock, castings and the like, which must be paid for within a very limited time after delivery, and which will go into machines that may be from six to nine months in the process of building.

With this demand for material in large quantities goes a natural increase in price.

With the demand for labor to build the machines goes a natural increase in the price of labor, and increase in the overhead expense.

It is inevitable that under these conditions of speculative orders and attendant cancelations, the manufacturer must advance his selling price. This advance is passed down the line as an additional expense to the machine-tool user.

The dealer in his turn suffers a loss for he must exert a certain amount of effort to get every order that he receives, and just in proportion as cancelations take place his profits are reduced. This results in a demand for a greater percentage of commission, and enters as another factor to increase the cost of the machine to the user. In yet another way the dealer's expenses are increased because of fixing salesmen's salaries and expenses upon a fictitious basis, partly of orders that are *bona fide* and partly speculative.

The AMERICAN MACHINIST stands ready to aid every movement that will improve the machine-building industry, and while advocating "no cancelations," appreciates that it may be impossible to lay down ironclad conditions. At the same time, cancelations should be far less frequent than they now are. The user should place orders on farsighted judgment of needs, not on wild guesses or rosy hopes; salesmen should never urge the ordering of a machine by holding open the loop hole of cancelation. Dealers, in general, should be permitted to order sample machines only, not an

enormous stock; surplus machines should be in reserve in the hands of the manufacturer.

With this as a basis for machine-tool orders, the manufacturer can gage his output accurately, estimate wisely for stock, order raw materials intelligently, plan his manufacturing equipment, build up his shop organization and handle his entire business on a sound basis.

There is nothing impractical whatever in this suggestion. "No cancelation" is a common provision of contracts for engines, boilers, air compressors, electrical machinery and many others. We know of at least one machine-tool building firm that has had this provision in its contract for eight or ten years, and its business has grown, and grown tremendously.

The consensus of opinion, as we are able to gather it, is in favor of adopting such a provision throughout the industry. Undoubtedly it will be done. What an opportunity for coöperation! What an opportunity for those firms that are large and powerful to lead, and thereby help those that are less influential!

The Ranken School of Mechanical Trades

There are few more striking examples of devotion to an ideal than shown in the gift of David J. Ranken, Jr., of St. Louis, Mo., of practically his entire fortune for the enlargement and maintenance of the school which bears his name. The gift amounts to more than $3,000,000, which is placed entirely in the hands of the board of trustees, and while larger amounts may have been donated by others, we know of no other case where it has left the donor comparatively poor.

It is stated that Mr. Ranken has lived for years in three small rooms over a grocery store, where he has worked out all the plans for this school and has accumulated the necessary means by denying himself many of the luxuries which his income might have procured.

Mr. Ranken's idea has been to found a trade school for boys over 15 years of age and to give them a thoroughly practical education in the trades at a very nominal fee. In addition to the money, Mr. Ranken gives what is even more valuable at times—personal service in visiting the school every day and watching the boys, as well as the character of their instruction. He insists that no time be spent in teaching theory which has no practical application and that everything taught in the lecture room be worked out in actual practice in the shop. The boys of St. Louis, as well as the mechanical industry of the country, are indebted to Mr. Ranken and his efforts should not be measured by the money donated, but rather by the desire to be of service to the boys and the example of self denial in order to accomplish this purpose.

Brutality in Design

At the recent meeting of the American Society of Mechanical Engineers, in Atlantic City, reference was made to machine tools designed many years ago by the honored member, John Fritz, for the Bethlehem Steel Company. In this reference they were characterized as "brutal in design." It was also stated that they were the only tools in the Bethlehem shop that were capable of measuring up to the requirements of high-speed steel when that was introduced.

Mr. Fritz was present at the session and said that when those machines were designed, the only way he knew of to obtain that all-essential quality, reliability, was to resort to massive proportions in the parts. The expression "brutal in design" is new as applied to machine tools, probably will come into but little use and wisely so. Yet it is merely a rough, forceful way of characterizing that element of design that leads to reliability.

Reliability in a machine is of more value to both builder and user than the last refinements of distribution of material in order to meet the requirements of computed stresses.

An engineer has been defined as a man who is constantly compelled to make up his mind. The limit of design in a machine part is obviously that point where it will break, distort, or wear out; in other words, where it becomes too weak. In its last stages, the paring of a design in order to bring it as closely as one dares to this lower limit is not a question of judgment, not a question of engineering, but a question of guesswork. Let us therefore have more intelligent brutality in design.

New Publications

Self Taught Mechanical Drawing and Elementary Machine Design. By F. L. Slyvester and Erik Oberg. 333 5x7¼-inch pages, 218 illustrations, cloth bound. Published by Norman W. Henley Company. Price $2. Reviewed by E. H. Fish.

This is another of the conventional books on the subjects stated. It begins with the use of instruments, geometrical drawing and projection; to the last 18 pages are devoted. Since under projections are included intersections, developments of surfaces and isometric projection, in addition to the whole art of third angle projection it will be seen that the treatment is hurried. Chapter V on working drawings is the best part of the book in that it gives in condensed form a large part of the conventionalities that occur in average drawing-room practice. There are brief chapters on formulas, trigonometry, treating of right triangles only, mechanics and strength of materials. Cams and gearing are given the major portion of the remaining space. Belt transmission, fastenings and quick return motions complete the book. Scarcely any attention is given to the design of machine frames, sliding or rotating bearings, momentum of reciprocating parts, oiling devices, etc. If this work is to be considered as a brief statement of well known facts, edited by the authors, it is well worth the price, but no one should buy it with the belief that by its use he can teach himself either drawing or machine design. As an aid or reminder to a teacher of drawing or to a man already familiar with shop and drawing room methods who wants to know what things he may profitably study more thoroughly this book will prove a valuable aid.

Personals*

Fred Holz and A. Hundert, of Donauwerke Ernst Krause & Company, of Vienna, who have been visiting the firms they represent, have returned to Germany.

A. C. Davis, formerly master mechanic of the Pennsylvania Railroad lines west of Pittsburg, has accepted the position of superintendent of the American Manufacturing Company, Jamestown, N. Y.

H. E. Bridgewater has been appointed superintendent of the Secor Typewriter Factory, Derby, Conn., to succeed P. C. Locke. Mr. Bridgewater has been in the employ of this company for the past eight years.

An important communication addressed to William A. Jones, formerly of Noroton Heights, Conn., has been sent him in our care. If he will advise us as to his present whereabouts we shall forward the communication.

Paul L. Joslyn, formerly occupying the position of mechanical engineer with the Minneapolis Steel and Machinery Company, has accepted a similar position with the Nordberg Manufacturing Company, Milwaukee, Wis.

C. H. M. Atkins, president of the Cincinnati Planer Company, has sailed for a four months' trip abroad. Mr. Atkins will visit England, Scotland and Ireland, and all of the countries on the continent before returning.

J. H. Zimmerman has recently resigned his position as superintendent of the Lamson Consolidated Store Service Company, Lowell, Mass., to accept the position of general factory manager of the Timken Roller Bearing Company, Canton, Ohio. Mr. Zimmerman has been located in his new field of duties since June 1.

*Items for this column are solicited.

New Tools and Shop Appliances

The Rochester Boring, Drilling and Milling Machine

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

The illustrations show the No. 3 size of a new machine built by the Rochester Boring Machine Company, Rochester, N. Y. Dimensions specified hereafter refer to this particular size. Two larger sizes are under construction and others will be built as the demand arises. This machine has a spindle 3⅛ inches diameter, with a continuous traverse of feed of 36 inches and has a No. 5 Morse taper. Any length of traverse can be obtained without resetting by simply lengthening the spindle. Vertical movement of saddle is 54 inches and horizontal traverse of column, 6 feet. Spindle, column and saddle can be traversed or operated either by hand or power, with fast or slow motion, as desired. Ball thrust bearings are used in all places where end pressure is exerted. The spindle is journaled in adjustable taper bearings provided with lock nuts and anti-friction collars. All gears are either nickel chrome steel, cast steel or manganese bronze and are carefully cut to make smooth running and noiseless gears.

The standard machines are arranged with electric motor drive. By placing the motor on top of the column, a most direct and efficient way of transmitting the power has resulted, eliminating many gears and shafts for transmission. With the severe conditions under which these machines operate, this arrangement has proved to be very convenient. A 3-horsepower constant-speed motor, running at 1000 revolutions per minute, on a No. 3 machine, gives ample power to run a milling cutter 12 inches in diameter at 80 feet or more cutting speed, with a heavy cut through cast iron.

The power is transmitted to driving mechanism by vertical shaft shown in front of column, all contained and inclosed in the saddle. This vertical shaft runs at 750 revolutions per minute and is controlled by friction clutches, operated by starting lever, shown in front of saddle. This lever controls the starting, stopping and reversing of driving mechanism in the saddle. In the neutral position, all clutches are disengaged and the shaft runs idle, while the driving mechanism in saddle remains at rest. In downward position clutch for forward running is engaged and in upward position clutch for reversing speed is engaged. On the right-hand side of the column a switchboard is arranged for stopping and starting of motor. The driving power is transmitted from the vertical shaft through the bevel gears and clutches to change speed gears, and by a tumbler-gear arrangement controlled by speed lever, desired speeds are obtained. The combination of back gearing gives 10 speed changes for spindle which, range from 15 to 200 revolutions per minute. For standard machine these speeds can be varied in the same ratio. All speed changes are arranged in geometric ratio. The intermediate shaft car-

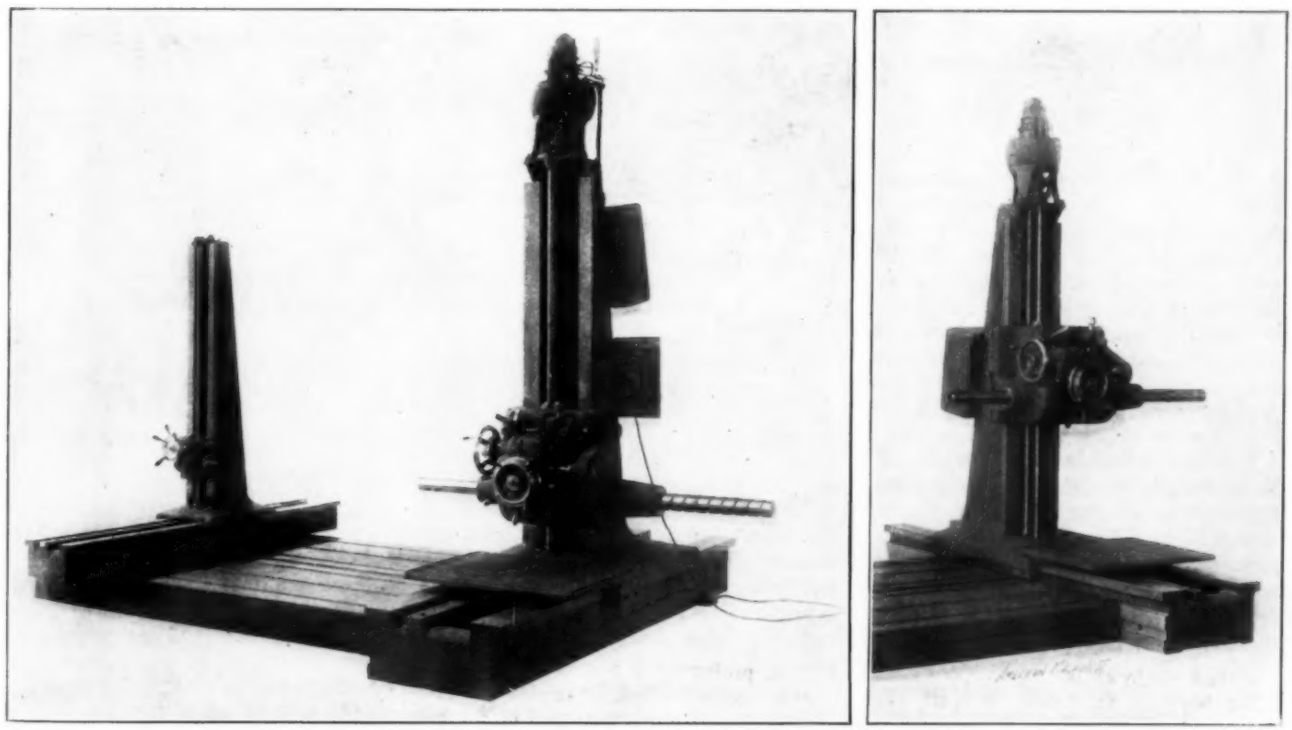


FIG. 1. TWO VIEWS OF THE ROCHESTER FLOOR BORING MACHINE

rying the clutches for driving back gearing, carries a pinion fastened to the end of the shaft. This pinion meshes into and drives a large gear mounted on a sleeve bushing. The sleeve drives the spindle by two spline-keys. By providing ample clearance between the sleeve and spindle, vibration from gears does not affect it.

The spindle is mounted in taper bearings of phosphor bronze adjustable from the outside, both being ground to size. The sleeve carrying the driving gear, and rotating the spindle, has teeth cut on one end which mesh into pinions driving a planetary gear. This planetary gear, through three pinions meshing into it, drives the rotary nut on the spindle by three other pinions. The nut has a heavy flange, which rotates between large ball thrust bearings with ¾-inch steel balls, and takes the end thrust from the bar in either direction. When the feed is disengaged, the nut is rotated at the same speed as the spindle and spindle remains

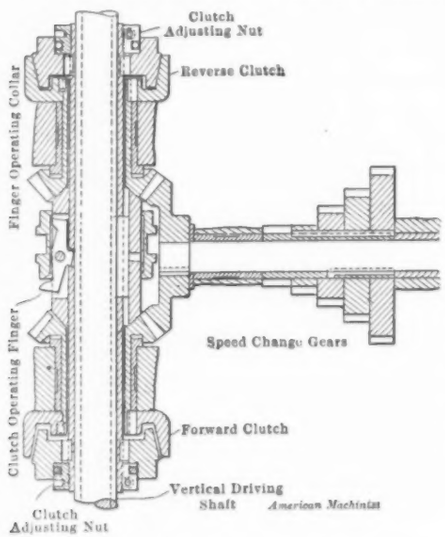


FIG. 2. THE DRIVING CLUTCHES

in a fixed position. By the planetary-gear system engaging the feed gearing, a differential rotation can be given the nut, advancing or retarding same. The advancing or retarding rotation effects the traverse of the spindle, and spindle is moved in either direction as desired, for feed. The driving pinions for planetary-gear system, are carried by spindle feed gear operated by feed-change gears. This is all clearly shown in Figs. 3 and 4.

The feed-change gears, arranged with back gears, give eight different feeds to the spindle, ranging in geometric ratio from 0.01 to 0.25. These gears are engaged by a sliding spring key, which can engage the gears in three places. The feed is reversed when desired by alternately meshing the driving pinion or an intermediate gear. Properly proportioned gear transmits motion from feed-change gears to shaft carrying feed hand wheel. A friction clutch, operated by clamping nut, shown on the outside of the handwheel, serves to engage the power feed, and can be adjusted to give a yielding point for safety of tools.

The inner handwheel is mounted in front of the saddle on a hollow shaft, which, by proper gearing, operates the traverse of column. The outer wheel controls motion of saddle on column, and the inner hand is provided with a double-end clutch, which slides on the hollow

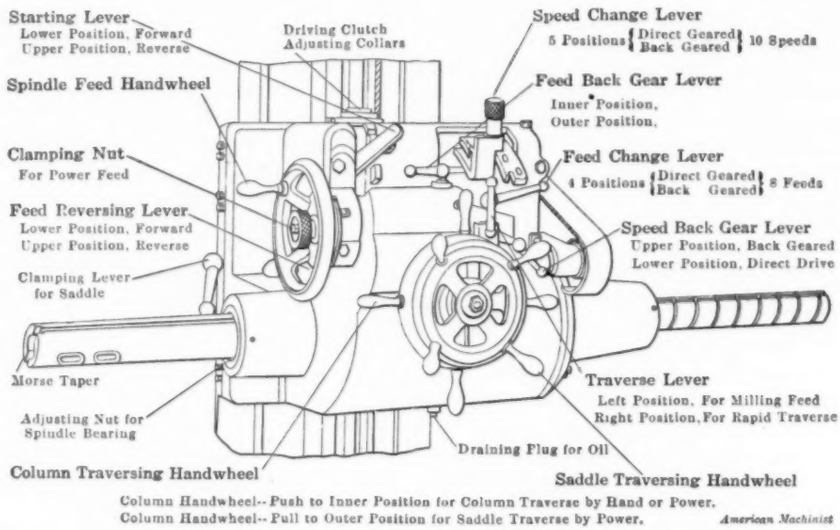

Starting Lever
Lower Position, Forward
Upper Position, Reverse
Driving Clutch Adjusting Collars
Speed Change Lever
5 Positions { Direct Geared / Back Geared } 10 Speeds
Spindle Feed Handwheel
Feed Back Gear Lever
Inner Position,
Outer Position,
Clamping Nut
For Power Feed
Feed Change Lever
4 Positions { Direct Geared / Back Geared } 8 Feeds
Feed Reversing Lever
Lower Position, Forward
Upper Position, Reverse
Speed Back Gear Lever
Upper Position, Back Geared
Lower Position, Direct Drive
Clamping Lever for Saddle
Morse Taper
Traverse Lever
Left Position, For Milling Feed
Right Position, For Rapid Traverse
Adjusting Nut for Spindle Bearing
Draining Plug for Oil
Column Traversing Handwheel
Saddle Traversing Handwheel
Column Handwheel--Push to Inner Position for Column Traverse by Hand or Power.
Column Handwheel--Pull to Outer Position for Saddle Traverse by Power.
American Machinist

FIG. 3. THE SELF-CONTAINED SADDLE AND HOW IT WORKS

shaft. Pulling the inner handwheel outward engages a clutch on the outer handwheel, and power drive is engaged to the inside shaft, transmitting motion to a rotating nut on elevating screw, which elevates the saddle. By pushing inner handwheel to its inner position, a clutch fixed in the hollow shaft is engaged, and the vertical shaft for traversing column is driven. These gearings connect with the feed-change gear without the back gears, and four feed changes are available in either direction for traversing saddle or column when milling.

The shaft carrying the worm that actuates the traverse has a clutch on the outside, by which direct high-speed constant gearing can be engaged, giving a rapid traverse for saddle and column and spindle of 6½ feet per minute. This shaft can engage either the feed gears, the rapid traverse gearing, or be entirely disengaged.

The saddle is perfectly counterbalanced by a weight sliding on the back of the column. The bearing on the outboard column for supporting the boring bars, is traversed by similarly concentrically arranged handwheels as on the saddle, but operated by hand only. Saddle column, as well as support column, has solid wedge gibs and clamping devices for locking in desired position. Only one rail of base slide is used for guiding column traverse, which gives a long, narrow bearing. The T-slotted base

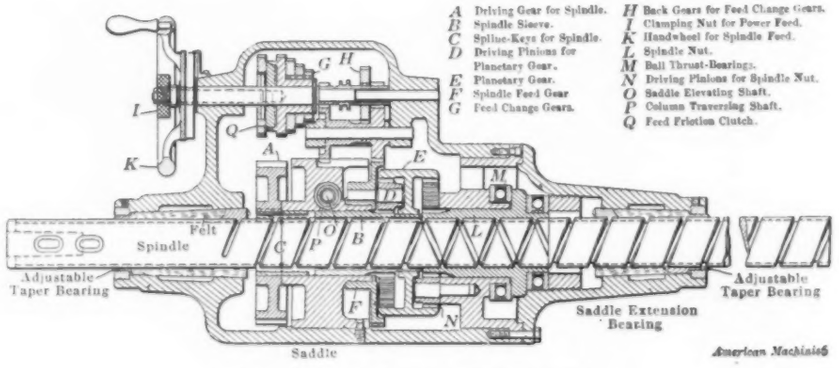


FIG. 4. THE SPINDLE MECHANISM

plate on standard machines is 6x9 feet, but can be varied to suit.

From the foot platform the operator can control every movement of the machine, from starting and stopping the motor to traversing the column saddle or spindle in any direction. Quick power motion can be used for traversing the spindle, saddle and column in any direction, which results in saving a great deal

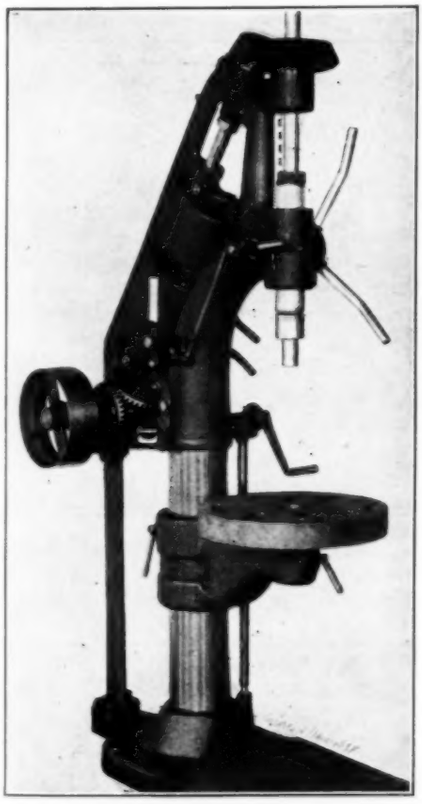
of time and labor and the machine is instantaneously started, stopped or reversed. The rated horizontal traverse for this size machine is 6 feet, but it can safely be operated for 7½ feet.

One of the special features is that the spindle can be fed its full length without reclamping, thus giving any required range of feed desired by using different length bars. The rotating of the nut and other parts with the spindle makes the feed very sensitive and the smallest drills can safely be used.

Graduated scales with vernier readings are provided for column and base slide as well as outboard support and slide. A micrometer reading is provided on the spindle-feed handwheel, in boring, drilling and milling.

All Geared Automatic Reversing Tapping Machine

The accompanying illustration shows a new all-geared automatic reversing tapping machine manufactured by the Barnes Drill Company of Rockford, Ill.



ALL-GEARED AUTOMATIC TAPPING MACHINE

While the general design is the same as the standard all-geared drill manufactured by this firm, it will be noted that there is but a single pulley for driving and reversing. The friction clutch gears give reverse speed of 1¾ to 1, these gears being on the driving end of the machine.

Automatic reversing mechanism is included for depth tapping. It can be set so that when the tap reaches depth required, spindle will automatically reverse, backing out at double speed. It may also be set so as to trip automatically (or by hand) stopping the spindle, instead of reversing it.

The small hand trip lever shown is for use if desired to reverse or stop spindle at any point in the operation.

There are no cone belts, there being four direct-geared speeds and four back-geared speeds, making eight available changes of geared speeds.

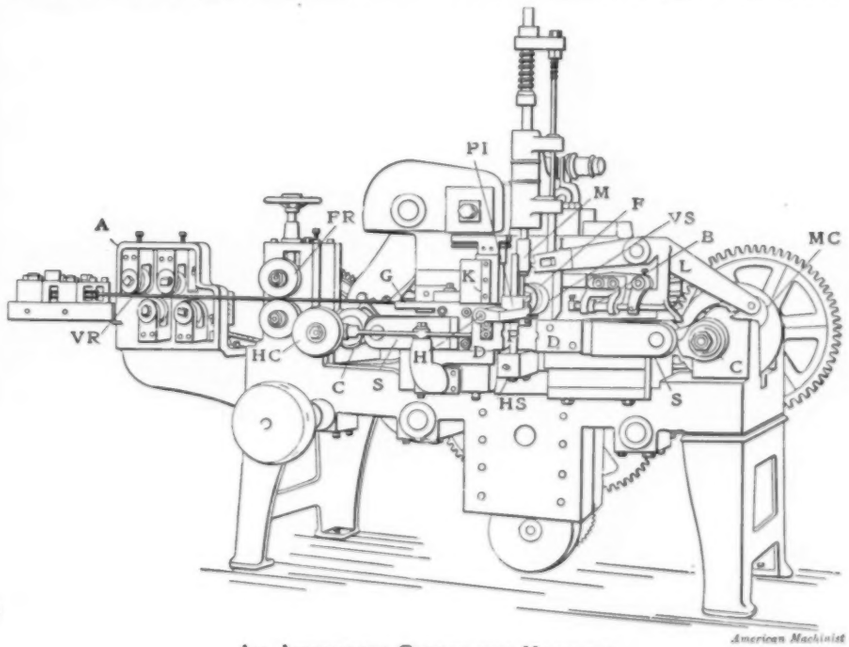
These machines are built in 20-inch and 24-inch sizes. The 20-inch machine drives a 1¼-inch U. S. Standard tap 125 revolutions per minute in cast iron without back gears. When back gears are in, it will drive a 1½-inch U. S. Standard tap 50 revolutions per minute in cast iron.

The 24-inch all-geared drill will handle up to 2 inches U. S. Standard tap.

With positive power feeds added to these machines, they can be used for both drilling and tapping.

An Automatic Cotter Pin Machine

In designing this machine the endeavor was to obtain a complete exposure of all its principal working parts in order that the tools might be readily adjusted without any obstruction. The machine here illustrated is built by the F. B. Shuster Company, New Haven, Conn., will form round keys from ⅜ to ⅝ inch diameter, and flat keys not exceeding 1½ inches wide. Pins of either description can be formed from 1½ to 7 inches in length. The three-step cone permits regulating the speed in proportion to the length of the pin to be formed.



AN AUTOMATIC COTTER-PIN MACHINE

The vertical rolls *V R* of the roll straightener *A* are geared together and driven by a chain from the lower feed roll shaft. The feed rolls are indicated at *F R*. On the lower roll shaft is a friction clutch, which is released automatically, thereby stopping the feed during the formation of a cotter pin. The guide *G* lines up the wire to pass directly under the cutoff knife *K*, and into the groove in the forming dies *D D*. These dies are secured to the slides *S S* that are actuated by cams *C C* on the side shafts. The former, or breaking down tool, is only indicated at *F*, since it cannot be seen on account of the part of the stripping mechanism being in front. It projects to the front from a sleeve in the vertical slide *V S*, and also to the rear of this slide and engages in a vertically slotted angle piece secured to the slide *H S*, which moves in a horizontal plane, but at right angles to the slides *S S*. The vertical adjustable post *P* is supported in the ends of the horizontal slide *H S* and carries the pin *P I*, around which the eye of the cotter pin is formed in the dies. The pin is also hidden from view by part of the stripping mechanism. The adjustable stop gage *B* is connected with the friction clutch on the lower feed roll shaft and releases that clutch when the wire has been fed into the machine to the proper length. The milling head *M* bevels the end of the cotter pin and is actuated by the cam *M C* and the levers *L L*. The stripping mechanism *H* is operated by the cam *H C*.

The operation of the machine is as follows: The wire passes through the straightener *A*, feed rolls *F R*, guide *G*, then over the dies *D D* and under the former or breaking-down tool *F*, until it strikes the stop gage *B*. This releases the friction clutch, stops the feed rolls and

immediately the wire is cut off at *K*, after which the former is carried down between the dies and bends the wire into a U shape. The horizontal slide *H S* then moves to the rear, withdrawing the former *F* from the U shape and inserting the pin *P I* into the place vacated by the former. The side slides *S S* then move forward toward the center, squeezing the free ends of the U together, thus forming the eye of the cotter pin around the pin *P I*. The cotter pin is held in this position until the milling head *M* descends and mills the bevel on the end of the cotter pin, for which the dies open and the stripper *H* removes the cotter pin from between the dies and strips it from the pin *P I*. When the cotter pin is removed from the dies the friction clutch is automatically thrown into operation and starts the feed for the next cotter pin.

Quick Change Sensitive Drill Press

In the accompanying illustrations is shown a new design of sensitive drill press now being put upon the market by

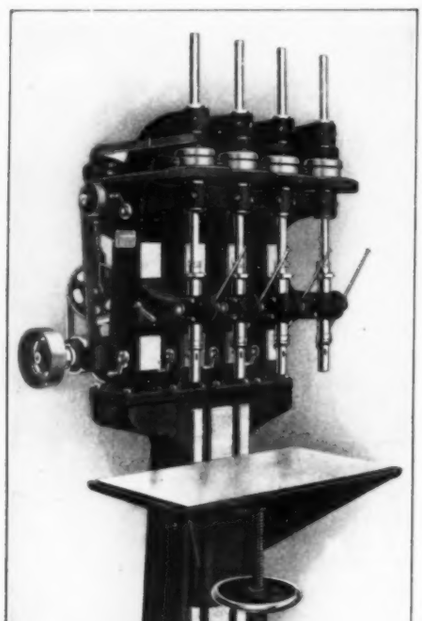


FIG. 1. QUICK-CHANGE SENSITIVE DRILL PRESS. MULTIPLE-SPINDLE TYPE

the Dwight Slate Machine Company, Hartford, Conn. The novel feature of this machine is the form of belt drive by which four speed changes are obtained by the shifting of two levers, but without the shifting of the belt, and without the use of cone pulleys. The illustration shows that a continuous belt, which is 1¼ inches wide by 17 feet long, passes several times around various pulleys and idlers. Speed changes are accomplished through cone clutches connecting to different sized pulleys which are mounted on stationary hollow quills, this latter arrangement being used to obviate side pull and friction on the spindles.

Four speeds are obtainable; 500, 800, 1280 and 2050 revolutions per minute. The control levers are on the side of the top column and are self locking in all positions. The lower lever also controls the starting and stopping so that, with the multiple-spindle machine, each spindle is independent of the others, and tight and loose pulleys are eliminated. The bearings of all the pulleys and spindles are of the ball type, to reduce friction and obviate the necessity of frequent oiling.

Spindles are balanced by flat coil

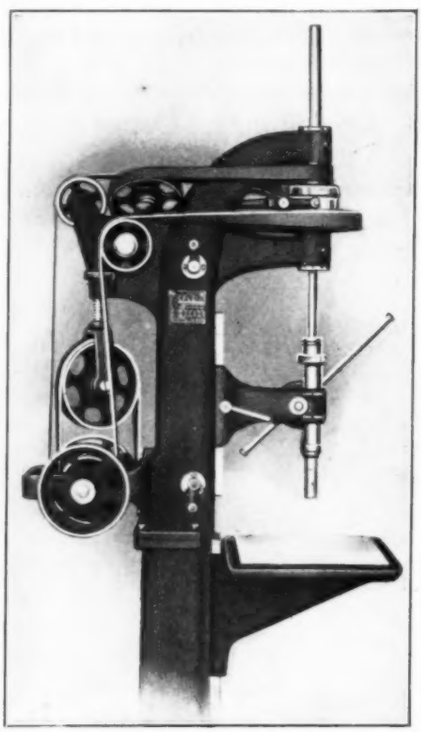


FIG. 2. DETAILS OF BELT DRIVE

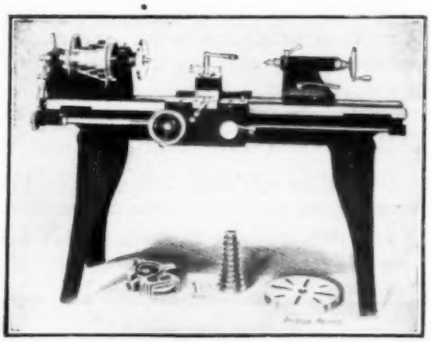
springs located in the sliding head. Adjustment may be made to exactly counterbalance the spindle, or if desired, the spindle may be automatically returned to the upper position. It is claimed that the spring gives a more sensitive feed than the usual counterweight. Positive depth stops are provided for each spindle.

In multiple-spindle machines all the spindles may be driven from a common shaft, thus all being limited to the same range of speed changes, although each independent of all the others, or if desired, separate drive may be provided for one or more spindles, so as to give a different range of speed changes for these latter spindles, for tapping, counterboring, facing, etc. The spindles are bored with No. 2 Morse taper, and they are intended to drive high-speed drills up to and including 29/32 inch diameter, to their full capacity.

This drill is also made in a motor-driven type.

Simple Engine Lathe

The accompanying cut shows an improved engine lathe built by the South Bend Machine Tool Company, South



NEW SOUTH BEND ENGINE LATHE

Bend, Ind. The lathe swings 13 inches over the bed, takes 33 inches between centers, and may be operated by either foot power or countershaft as desired. It is a lathe of simple design and construction and contains all the necessary practical features to take care of a general line of repair-shop work as well as being suitable for manufacturing small parts in large quantities.

A Heavy Pipe Threading Machine

The halftone shows a pipe-threading machine for pipe from 4 to 12 inches diameter. It is equipped with a 10-

A HEAVY PIPE-THREADING MACHINE

horsepower Westinghouse squirrel-cage type induction-mill motor. The machine has 10 gradations of speeds and threads pipe at a cutting speed of 28 feet per minute. It is built by the Stoever Foundry and Manufacturing Company, Myerstown, Penn.

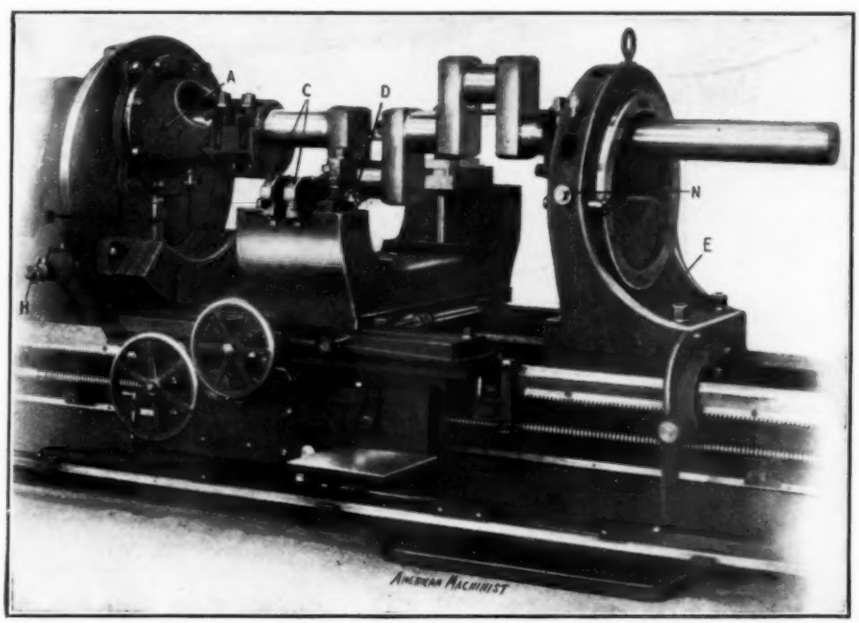
The "Beaver" Pipe Die Stock

This die stock is made with narrow dies which recede to form the pipe taper. This makes an easy cutting die so that a man is said to cut a 2-inch thread without difficulty. Pipe from 1 to 2 inches is threaded with one set of dies by simply shifting a cam. A universal chuck centers and grips all sizes of pipes by a cam movement and without the necessity of loose bushings, grip screws or loose parts of any kind.

This is made by the Borden Company, Warren, Ohio.

Lodge & Shipley 36x42-inch Crank Shaft Lathe

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has recently built a lathe for turning large crank shafts. It is a 36-inch standard patent-head lathe, swinging 42 inches over the shear, with the crank shaft in place. The halftone gives details of the crank-shaft turning attachment.



CRANK-SHAFT LATHE

A swiveling chuck *A* attached to the faceplate, carries one end of the crank shaft by securely gripping it in a bearing having a hinged cap. The base upon which the chuck swivels has a tongue which fits a planed slot passing through the center of the faceplate. Thus the swiveling chuck can be placed with its center coincident with the center line of the lathe to turn shaft bearings, or it can be set eccentrically any desired amount to turn shaft pins. The swivel base allows the shaft to be turned to set for pins at different angles. A steel strip *B*, bolted in the slot at one side of the chuck plate, locates the chuck at just the proper distance off center to give the correct throw for the crank pin to be turned. The weights attached to the faceplate opposite the chuck are to counterbalance the chuck and crank shaft when turning the pins.

When turning the pins, the outer support *E* holds the tail end of the crank shaft. This outer support is a carrier chuck, but not a driving head, as the drive for the crank shaft is from the faceplate end only. The shaft is held at the proper distance off center by being gripped in a hinged bearing which is attached to the central rotating chuck. There is an annular bearing in the outer support, so that the chuck carrying the eccentrically located shaft is free to revolve. Thus the clamping bearings of both the swiveling chuck and the outer support can always remain in line as the shaft revolves. This outer support also serves as a steady rest, by gripping the shaft close to one of the cheeks.

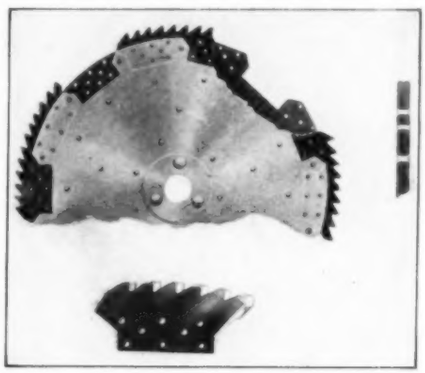
Locking pins at *H* and *N* bring the two clamping bearings into exact alinement with each other before the hinged caps are finally tightened to grip the crank shaft. The faceplate locking pin is carried in a bracket attached to the inner ways of the bed; a star knob on the front of the bracket furnishes convenient means for sliding the pin into or out of its seat in the faceplate. The locking pin in the outer support is similarly operated. Before placing the crank shaft in the lathe, the two locking pins are slipped into their seats. This exactly alines both chucks so that the shaft can be placed in them and gripped, without danger of springing. The locking pins are then withdrawn, leaving the chucks and shaft free to revolve.

Connected front and rear tool rests are used. Both tool rests are cast in one piece with the long cross slide that is mounted upon the bridge of the carriage. This slide has power feed and hand movement. An upright post gives a firm support to each tool almost out to the cutting point.

The front block carries three tools. Two of these *C* are for facing the cheeks of the shaft and are carried in a hinged holder so that they can be thrown back when not in use; the third tool *D* turns the cylindrical portion of the pin. The rear tool rest has a holder containing two cutting tools spaced just the proper distance apart to fillet the ends of the pin, and thus determine the length of the portion which is to be turned. Multiple stops for length and cross feeds are included in the equipment.

A Metal Saw with Inserted Teeth of High Speed Steel

In this metal saw the teeth are of high-speed steel and the body is constructed of two crucible-steel plates riveted together. The teeth are inserted and securely riveted to the crucible steel plates from alternate sides and can be replaced when worn out. The saw is not liable to fracture, as the body plates are made of the best crucible steel for the purpose and given a very tough temper insuring a tough and rigid blade. The saws are made in two sizes, 24 and 32 inches diameter, ¼ and 5/16 inch thick respectively. The thinness of this saw is one of its important advantages as a thin blade naturally cuts with less strain and requires less power than a thick one. This saw is made by Huther Bros., 1190 University Ave., Rochester, N. Y.



A METAL SAW

Averaging Instrument for Circular Chart Records

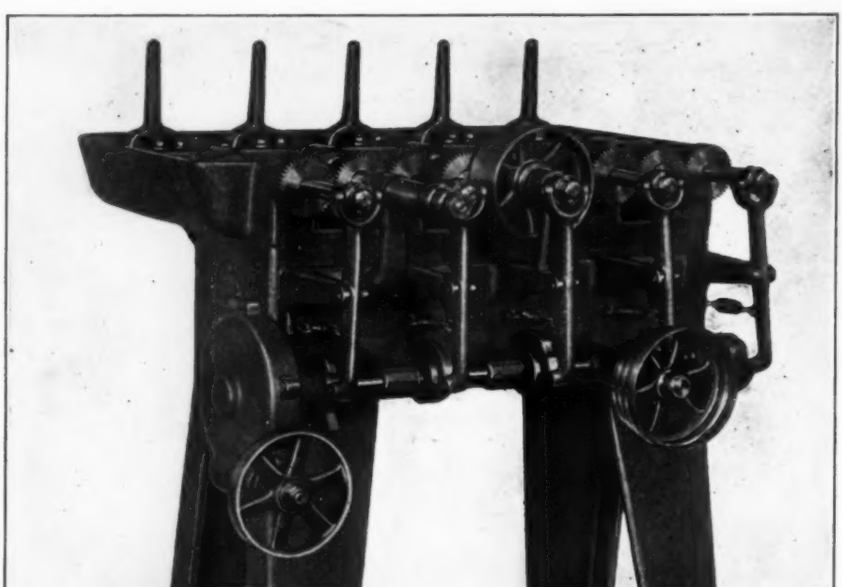
The accompanying illustration shows an instrument devised by Prof. W. F. Durand, of Stanford University, and manufactured by the Bristol Company, Waterbury, Conn. The object of this instrument is to determine the average reading from a circular chart record, such as is drawn by many of the commercial recording thermometers, pressure gages and the like. In operation,

INSTRUMENT FOR AVERAGING CIRCULAR CHART RECORDS

the chart is revolved upon a pivot at its center while the triangular frame at the end of the wheel shaft is grasped by the operator, between thumb and finger, and this frame, with the shaft and wheel, is pushed forward and backward through the slot in the central upright post (which latter does not revolve) so as to cause the needle depending from the shaft, near the recording wheel, to follow out the curved line traced upon the revolving circular chart. The reading on the rim of the wheel, which is divided into 100 parts and provided with a vernier reading to 1/10 of a division, gives the average radius of the irregular curve drawn upon the chart. This average radius is the average pressure or temperature desired, as the case may be. The principle of working is that the longitudinal sliding of the shaft does not produce any rotation of the wheel, whereas the rotation of the chart does produce rotation of the wheel and the degree of rotation depends upon the length of all the component elementary circular arcs of which the irregular curve may be considered to be composed. As the length of a circular arc within a given angle is in direct proportion to its radius, the measurement of the sum of all these elementary arcs is in direct proportion to the average radius, which is the dimension desired. The instrument is equally applicable to charts having either straight radii, or circular-arc radii, this latter form being the most common for this type of recording instruments.

Special Drilling Machines

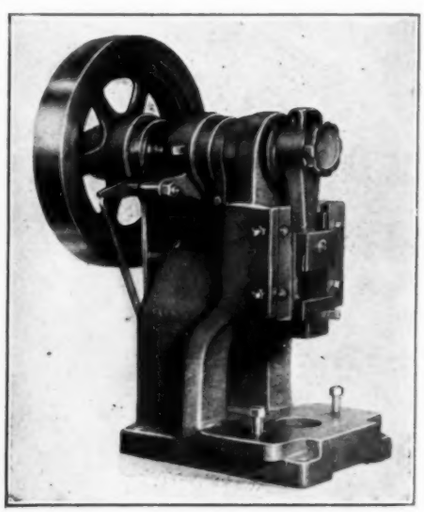
The illustration shows a special five-spindle drilling machine, made by the Buckeye Machine Tool Company, 2617 East 76th street, Cleveland, Ohio. This machine has been particularly designed for drilling small crossholes in the ends of bolts, studs, rivets or similar pieces for the use of cotters or other retaining devices as has become common practice in automobile, railroad and other classes of work. The operator simply clamps the pieces to be drilled, one after the other, in clamping jaws controlled by the upright levers shown at the back of the machine. These clamp the work so that the hole will be drilled centrally and also at the correct distance from the end of the bolt. The drill is fed automatically by the hands located on the horizontal shaft running across the front of the machine. Any desired feed can be had in this way, or, as shown by the central cam, a dwell or a light backward movement of the drill may be had if found necessary to help clear it from chips. This machine allows very rapid production and can be easily operated by any bright boy.



SPECIAL DRILLING MACHINE

Power Bench Positive Stop Clutch Press

This is a medium weight bench press. The special feature is the new one-revolution positive stop clutch. This clutch is operated in the usual manner with a foot treadle and is released by a cam point striking a knuckle piece, which in its movement slightly raises the pull-down latch and at the same time pushes it off the clutch lever, releasing the lever in ample time to engage the driving key, which in turn pulls out and stops against a positive projection, making it impossible for the press to repeat. To arrange the press for continuous running, it is only necessary to loosen a nut and drop the knuckle piece.



POWER BENCH PRESS WITH POSITIVE STOP CLUTCH

The press has a stroke of 1½ to 2 inches, the die bed is 8x13 inches, the wheel 16 inches and the weight 375 pounds. It is made by the Atlas Machine Company, Waterbury, Conn.

To make a file take hold better, dip it occasionally in gasolene. Have a bottle full of the liquid handy, but always keep it corked to prevent its rapid evaporation.

Aeroplane That Flew to Philadelphia

By Augustus Post

A record breaking aeroplane flight from New York to Philadelphia and return.

Average speed on return trip reaches 51.36 miles per hour.

Machine used was Curtiss type specially equipped for long distance flight.

The central or power section of the aëroplane used by Charles K. Hamilton in his record-breaking flight from New York to Philadelphia and return on June 13, is shown in the accompanying halftone. This flight will probably go down in the history of aviation as one of the most important ever made in the early development of the art of flying. It is notable, not only for the fact that a continuous flight was made from New York to Philadelphia—a distance of some 86 miles and the longest single flight ever made in the United States—but also for the fact that Mr. Hamilton was compelled to land in the marshes near South Amboy and succeeded in making the necessary repairs, rising into the air once more and reaching Governor's island, his starting point, during the same day. Thus it was demonstrated that the aëroplane could not only fly for long distances, but that it could alight on necessity, even under the most unfavorable conditions, and then rise again and continue its flight. It is undoubtedly a source of congratulation that Mr. Hamilton was compelled to land in the Jersey marshes, for by so doing he has shown us yet another proof of the reliability toward which the aëroplane is rapidly developing.

AEROPLANE USED BY CHARLES K. HAMILTON IN NEW YORK TO PHILADELPHIA FLIGHT

RECORD OF THE FLIGHT

Mr. Hamilton left Governor's island at 7:36 a.m., making a wide circle over the level ground of the island, then rising rapidly to a hight of about 200 feet; a minute and a half later he passed over his starting point and continued turning until 7:43, when he passed over New York bay at a speed of over 45 miles an hour and headed for Elizabethport, N. J. There he picked up the special train which was to accompany him over the tracks of the Pennsylvania railroad, passing through Trenton to Philadelphia. He reached Philadelphia at 9.26 a.m.

He left Philadelphia for New York on the return trip at 11:30 a.m. and reached South Amboy, where his motor began to skip badly, and he was forced to land. This landing was made on the marshy ground along the shore of the Raritan river. In landing the propeller was broken, and it was found necessary, not only to replace this, but also to replace a broken spark plug. After the repairs were made the machine was carried to the higher ground of the country road and a start was made at 6:17 p.m.

Governor's island was reached at 6:40 p.m., 11 hours after leaving.

The time made to Philadelphia was 1 hour and 50 minutes; Philadelphia to South Amboy, 1 hour and 21 minuts; South Amboy to Governor's island, 23 minutes; total distance covered to Philadelphia and return, 175 miles; total time in the air, 3 hours and 34 minutes. Average speed 46.92 miles per hour, on the trip from New York to Philadelphia; average speed from Philadelphia to New York, 51.36 miles per hour.

THE MACHINE

The machine used by Mr. Hamilton was the same aëroplane used by Glenn H. Curtiss in winning the International aviation cup at Rheims last year, and is essentially the same as the machine used by Mr. Curtiss in his Albany-to-New York flight. Some additions, however, were made to the machine in order to prepare for the long flight of 86 miles without a stop.

A large torpedo-shaped gasolene tank 5 feet long, 1 foot in diameter, holding 20 gallons, was fitted above the engine and directly underneath the upper plane, replacing the standard tank which only held 7 gallons.

The radiator of the engine was enlarged by soldering cylindrical cans of about the size of a tomato can and holding a little over a quart apiece, one on either side of the top of the radiator. These details are plainly shown in the halftone illustration. The oil tank was also enlarged and held a little over two gallons of oil.

No floats, air bags or other means for sustaining the machine in the water were added, although the flight led over New York bay and the Kill von Kull.

The surfaces, or sustaining planes, are the same as the standard machine, 26 feet by 4 feet 6 inches. New ailerons were added of stiffer construction, 7 feet by 2 feet 11 inches, these being 3 feet wider than the old ones. The flying weight was approximately, gasolene 175 pounds, oil 40 pounds, water 75 pounds, aviator 110 pounds, engine 225 pounds, plane 300 pounds, making a total of 925 pounds.

In starting Mr. Hamilton broke the propeller with which the machine was fitted, and it was necessary to replace this by the one used by Mr. Curtiss in his Hudson-river flight. This propeller, which was made of laminated mahogany and spruce, is 7 feet in diameter and gives a thrust of over 300 pounds.

Trade of the United States with France for the fiscal year just ended will probably aggregate 250 million dollars, the largest on record; divided between exports and imports within 10 million, the larger amount falling to the latter. Of the exports for the 10 months ending with April metal working and electrical machinery amounted to close to one million dollars.

Increasing Shop Capacities

John Jennings will build a sawmill at New London, Wis.

Jacob Kaufman is extending his planing mill at Berlin, Ont.

The "Soo" Line will build a 15-stall roundhouse at Irvine, Wis.

The city of Toronto, Ont., will buy $20,000 worth of water meters.

The Strathroy (Ont.) Furniture Company is building a large addition.

The Cataula (Ga.) Canning Company will establish a canning plant.

The Wundur Furniture Company, Berlin, Ont., is doubling its plant.

The Toronto Engraving Company will erect a new plant to cost $150,000.

The Belmont Iron Works, Eddystone, Penn., is erecting a new power house.

The Berlin (Ont.) Foundry Company is making extensions to its plant.

The Canadian National Carbon Company will erect a factory in Toronto.

The Narcross Marble Company will establish a plant at Bridgeburg, Ont.

The National Bag and Paper Company will erect a $500,000 plant at Ottawa.

The Monitor Harrow Company will erect a large factory at Bridgeburg, Ont.

The American Gas Machine Company will erect a plant at Albert Lea, Minn.

The Waterloo (Ont.) Furniture Company is erecting an addition to its plant.

The Malleable Iron Company, Bridgeport, Conn., will improve its power plant.

John Treber will erect an ice plant at Pluma, S. D., to cost about $25,000.

John Gerstacker, Deer Lodge, Mont., will rebuild his brewery, recently burned.

The Strathroy (Ont.) Canning Company will double the capacity of its plant.

The Woodward Iron Company, Bessemer, Ala., is to erect a $700,000 coke plant.

The New England Paper Bag Company, Waltham, Mass., is enlarging its plant.

The Toronto (Ont.) Plate Glass Company is erecting a large addition to its plant.

The George J. Lippert Table Company, Berlin, Ont., is erecting a three-story factory.

The Sayles Bleachery Company, Saylesville, R. I., will install a filtration plant.

Medicine Hat, Alberta, will spend $50,000 for new equipment for electric-light plant.

The French Foundry Company will erect a $6000 smelting plant at New Brunswick, N. J.

The Hidden Creek Mining Company will erect a $50,000 smelter at Goose Bay, B. C.

The Lewis Spring and Axle Company, Jackson, Mich., is erecting a two-story addition.

The Nemasket Worsted Mills, Middleboro, Mass., will add to its electrical equipment.

L. Martin & Wilches Comapny, Camden, N. J., will build an addition, also new power plant.

The American Emery Wheel Company, Providence, R. I., will erect addition to its plant.

The Chippewa Sugar Company, Chippewa Falls, N. Y., is looking for site for a new plant.

Wood, Vallance & Co., Hamilton, Ont., hardware manufacturers, are extending their plant.

The McLaughlin Motor Carriage Company, Oshawa, Ont., will erect an addition to its plant.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Cockshutt Plow Company, Brantford, Ont., will spend $350,000 on extensions to its plant.

The Oregon & Washington Railroad will establish extensive repair shops at Centralia, Wash.

The city of Petersburg, W. Va., plans construction of waterworks and electric-light plant.

The London (Ont.) Concrete Machinery Company will erect a new plant in East London.

The Cascade Lumber and Shingle Company, Snohomish, Wash., will rebuild a mill at once.

The citizens of Canton, Kan., voted $30,000 bonds for an electric-light plant and waterworks.

The Waterloo (Iowa) Gasolene Engine Company is erecting an addition to its foundry.

The Mooney Biscuit Company, of Stratford, will erect a $250,000 plant in Winnipeg, Manitoba.

Bill has been passed appropriating $1,250,000 for a new Federal building in New Haven, Conn.

A. Graesser will establish at Guelph, Ont., one of the largest chemical works in America, it is said.

The Interstate Automobile Company, Muncie, Ind., is preparing to erect an addition to its plant.

The Otis-Fensom Elevator Company is building large additions to its plant in Hamilton, Ont.

The city of St. Augustine, Fla., will install new machinery in its waterworks. Address the mayor.

A new forge shop is to be erected for A. Finkel & Son, at 1336-38-40 Crooked street, Chicago, Ill.

The Merchants Rubber Company, Berlin, Ont., is erecting extensions to its plant to cost $10,000.

The Rockford (Ill.) Desk Company has let contract for the construction of two additions to its plant.

The Dominion Steel Company will equip a $1,000,000 wire and nail factory at Sydney, Cape Breton.

The Garry Iron and Steel Company, Cleveland, Ohio, will move its plant to Niles, Ohio, about July 1.

The Metropolitan Power Company, of Petrolia, Ont., will build a large power plant near Ottawa.

The Wisconsin Incubator Company, Racine, Wis., will shortly build a plant at a cost of about $10,000.

The National Oil Core Company will build a two-story factory at 51-75 Alabama street, Buffalo, N. Y.

The Northern Casket Company, Fond du Lac, Wis., will erect additions to its plant to cost $20,000.

The Cutler Desk Company, Buffalo, N. Y., will erect an addition to its plant, tripling present capacity.

The Columbia Mesh Knitting Company, Albany, N. Y., is contemplating the erection of an additional mill.

The Warner & Swasey Company, Cleveland, Ohio, will erect at once a five-story addition to its plant.

The Aluminum Casting Company, Fairfield, Conn., has awarded contract for the construction of an addition.

Henry McKnight, San Diego, Cal., manufacturers of porcelain ware, is looking for site for a new plant.

The John H. Kaiser Lumber Company will remove its box factory from Muscatine, Iowa, to Eau Claire, Wis.

Extensive improvements will be made to the sawmill of the Waterman Lumber Company, Marshall, Tex.

Vickers Sons & Maxim has filed plans for a $2,500,000 shipbuilding and repairing plant at Montreal, Canada.

The Lancaster (Ohio) Woolen Company will move to Marysville, Ohio, where a new plant will be erected.

The Marysville (Cal.) Water Company is erecting an annex to present plant to house auxiliary water system.

The Russell Grader Manufacturing Company, of Minneapolis, Minn., will rebuild its factory recently burned.

The Mobile (Ala.) Stove and Pulley Works is said to be looking for site on which to establish a branch plant.

The Manteuffel Refrigerator Company, Minneapolis, Minn., will rebuild its factory recently destroyed by fire.

The Canada Foundry Company, of Toronto, will spend $100,000 equipping a structural steel plant at Bridgeburg.

The Germofert Manufacturing Company, Charleston, S. C., will erect additional buildings at its fertilizer plant.

John C. Hansen, of Chippewa Falls, Wis., is planning the erection of a factory for the manufacture of keyless locks.

The Crittenden Roofing and Manufacturing Company, Minneapolis, Min., will erect a new factory to cost $12,000.

The J. R. Watkins Medical Company, Winona, Minn., is considering the erection of a six-story addition to its plant.

It is reported the Michigan Stove Company, of Detroit, Mich., is planning the establishment of a plant in Canada.

F. J. Finn is putting up a three-story building on Tenth street, St. Paul, Minn., to be used as a tin shop and factory.

The Canada Pin Company will erect a factory at St. Marys, Ont., for the manufacture of pins and other small articles.

The Enameled Concrete Machinery Manufacturing Company, Des Moines, Iowa, is trying to secure site for a new plant.

The Coshocton (Ohio) Brick Company is making extensive improvements at its plant. Capacity is to be increased one-third.

Contract has been awarded for the erection of a five-story addition to the Globe Knitting Works, Grand Rapids, Mich.

The New York Central Railroad Company is planning to build a large roundhouse in Brighton, outside of Rochester, N. Y.

The Beacon Manufacturing Company, New Bedford, Mass., manufacturing cotton blanketc, will make extensive improvements.

The Peterborough Light and Power Company will spend $125,000 in equipping an electrical power plant at Auburn, Ont.

The Batesville (Miss.) Manufacturing Company is looking for suitable location on which to erect large woodworking plant.

Worth Brothers Company, Coatesville, Penn., boiler-plate manufacturers, are building a large addition to the west tube mill.

The Couple Gear Freight Wheel Company, Grand Rapids, Mich., will erect a one-story addition to be used as an erection house.

The Levinson Manufacturing Company, Jersey City, N. J., manufacturing chairs, will erect a three-story addition to its factory.

Jackson & Church, Saginaw, Mich., have purchased site and have plans drawn for a new foundry, machine shop and boiler shop, etc.

The Connecticut Company, formerly Consolidated Railway Company, is planning extensive additions to repair shops in New Haven, Conn.

The Machine Screw Company has taken out permit for the erection of a $10,000 factory building on Truman street, New Haven, Conn.

The Dobbins Soap Manufacturing Company, Camden, N. J., will build a three-story addition to its plant, also build a new power house.

The city of Orlando, Fla., contemplates expending $100,000 for the construction of waterworks. J. O. Freis, Orlando, is engineer.

The Avery Manufacturing Company will build a plant at Fargo, N. D., for the manufacture of agricultural implements to cost $60,000.

Hugo Bilgram, of the Bilgram Machine Works, Philadelphia, Penn., has purchased adjoining property with a view of enlarging foundry.

The International Aviation Association, Ltd., will establish a $100,000 plant in Montreal for the manufacture of aëroplanes and balloons.

Parke, Davis & Co., Detroit, Mich., are planning new additions to their chemical plants, which will require an outlay of about $200,000.

The city of Westernport, Md., contemplates the issuance of $100,000 bonds for improvement and extension of waterworks. Address the mayor.

The Phillips & Buttorff Company, Nashville, Tenn., manufacturing stoves and household furnishings, will build an addition to its factory.

The Hildreth Manufacturing Company, Lansing, Mich., has started the erection of additions to its foundry, machine shop and cleaning room.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 28 for turret lathe as per Schedule 2613.

The tinning and galvanizing department of the E. T. Wright Company, Hamilton, Ont., which was recently damaged by fire, is to be rebuilt at once.

A three-story factory building will be erected at Thirty-seventh and Reed streets, Philadelphia, Penn., for the Philadelphia Rubber Works.

Captain Peter Smith, shipbuilder of Scranton, Miss., is trying to secure suitable location for establishing large and modern shipbuilding plant.

The Electric Controller and Manufacturing Company, Cleveland, Ohio, has purchased site at Newburg, on which new and modern plant will be erected.

The Schoenberg Manufacturing Company, St. Louis, Mo., making moldings and screens, will build a three-story factory at 2014-18 De Kalb street.

The Keystone Leather Company, Camden, N. J., will build machine and pipe shop, also new power house. New Engines and boilers will be installed.

The Milwaukee (Wis.) Machine Tool Company, which has purchased site in West Allis, will erect a plant at once. About $50,000 will be invested.

Survey is being made of the site for the Vulcan Steam Shovel plant at Evansville, Ohio. It is said operations will commence about midsummer.

W. A. Stevens, of the Stevens Iron Works and Fireproofing Company, Cleveland, Ohio, will erect a new shop on Perkins avenue, near East Fortieth street.

The Conant-Bryant Power Company, Wilson, N. Y., has been authorized to issue $25,000 stock to be used for establishing electric power plant.

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has taken out a permit for the erection of a three-story pattern house to cost $10,000.

The Interborough Rapid Transit Company has taken out permit for the erection of a one-story shop at Ninety-ninth street and Park avenue, New York.

The Milwaukee (Wis.) Electric Railway and Light Company will erect an addition to the Chambers street power plant to provide for addition 60,000 horsepower.

The Hummel & Downing Company, Milwaukee, Wis., is planning the erection of a new plant to cost $350,000. The company manufactures folding boxes.

H. E. & C. D. Williams, 41 Spruce street, New York, leather manufacturers, are looking for site in the Middle Atlantic section on which to erect a new plant.

It is reported that the Pamlico Chemical Company, of Rayboro, N. C., has purchased site at Washington, N. C., on which a large fertilizer plant will be built.

The Huron Milling Company, Harbor Beach, Mich., will build an addition to be used as machine shop for repair work and will also extend engine room.

Thomas Potter's Sons Company, Philadelphia, Penn., has awarded contract for the erection of a new three-story factory to be used for manufacturing oilcloth.

The Western Canada Electric Company, incorporated at $1,500,000 and with headquarters in Montreal, is to carry on the electric-light and power business.

The Adamantine Clay Products Company, Martinsburg, W. Va., will commence work at once on a plant which is to be one of the largest of its kind in the country.

The Breeze Lumber and Manufacturing Company, Portsmouth, Ohio, will establish a plant at Selma, Ala., for manufacturing hardwoods for automobile factories.

The Imperial Brass and Manufacturing Company, Chicago, Ill., has purchased site at Center avenue and Harrison street, and will erect a $150,000 plant thereon.

Contract for the construction of a power plant at Randall, for the N. Y., P. & O. Dock Company has been awarded to F. C. Werk, New England building, Cleveland, Ohio.

The Taft-Pierce Manufacturing Company, Woonsocket, R. I., will add 30 new milling machines, 25 lathes, five grinders. Present capacity of tool room will be tripled.

The Boston & Northern Street Railway Company is contemplating the installation of an 1800-kilowatt generator in the Salem, Mass., power house in the near future.

The Booth Manufacturing Company, of Muskegon, Mich., manufacturing office furniture, is making investigation with a view of securing site on which to erect a new plant.

The A. R. Miller Seating Company plant, Columbus, Ohio, has acquired of the Ohio Brass and Manufacturing Company, and is fitting up same for the manufacture of opera chairs.

The Business Men's Association, Kewanee, Ill., has given site and will lend money for factory buildings to a new concern known as the Kewanee Foundry and Manufacturing Company.

The Quaker Oats Company, of Chicago, Ill., will erect at Richford, Vt., a mill and elevator for the manufacture of stock-seed grain to replace one destroyed by fire some time ago.

The W. C. Heller Company, Montpelier, Ohio, will erect a two-story addition, also dry kiln, and install additional engine and boiler. The concern manufactures hardware shelving, boxes, etc.

A $10,000 garage will be erected on Broad street, near Logan station, Philadelphia, Penn., for G. C. Seidel, of the real-estate firm of G. C. Seidel & Co., and will be known as the Logan Garage.

The Heald Machine Company, Greendale, Worcester, Mass., will erect an addition to be used for manufacturing and erecting purposes. New machine tools and electric traveling crane will be installed.

The Canton (Ohio) Electric Company will spend $400,000 for improvements to its power plant at East Seventh street and will also construct a $175,000 addition to be used as a boiler room.

Albert K. French, of Northfield, Vt., and A. J. Colombo have patented a new pneumatic stone-cutting tool and are interested in the organization of a new company to take up the manufacture of same.

Frank Bishop, 1241 Michigan avenue, South Bend, Ind., is interested in the formation of a company for the purpose of manufacturing a new refrigerating machine to be known as the Emerson-Bishop.

The Amphion Company, Syracuse, N. Y., manufacturing piano players, is negotiating for a factory building which will be equipped with new wood and metalworking machines. An addition may be built later.

Sealed proposals will be received at the office of the commanding officer, Rock Island Arsenal, Rock Island, Ill., until June 29, for furnishing four horizontal tubular boilers, 100 pounds steam working pressure.

The National Brake and Electric Company, Milwaukee, Wis., which has recently built several additions and is now building a new foundry building, is to put up two more buildings at a cost of over $125,000.

The Bethlehem Steel Company has purchased the plant of the Goubert Manufacturing Company, at Bergen Point, N. J., which went into the hands of a receiver some time ago. The plant will be enlarged, it is said.

The Wisconsin Motor Manufacturing Company, now in North Milwaukee, Wis., has purchased site in West Allis and is preparing to erect a plant to cost $150,000. The company manufactures automobile engines of all kinds.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m.,

July 18, for deformed steel bars, manganese steel rings for rock crusher screen, pneumatic hoist, gasolene motor, etc., as per Circular No. 591.

The Edgar Allen American Manganese Steel Company has purchased the plant of the Tropenas Steel Company, at New Castle, Penn. The new company expects to enlarge its plant. Rudolph Ortmann, of Chicago, is president.

The Dennison (Ohio) Sewer Pipe Company, recently organized, will erect a plant for the manufacture of fireclay articles on the east side of the Stillwater. Theodore Lanning, Maurice Moody, Nelson I. Boiney, are among the organizers.

Sealed proposals will be received at the bureau of yards and docks, Navy Department, Washington, D. C., until 11 a.m., July 2, for one 15-ton, 3-motor traveling crane for Mare Island navy yard. Specifications can be had of R. C. Holyday, chief of bureau.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 5, for twelve 12-horsepower oil engines (schedule 2630); July 12—Six trolley hoists (schedule 2615); July 19—Electric elevating gun equipment (schedule 2612).

The Indiana Steel Company, of Gary, Ind., has purchased 20 acres of land on which will be erected a plant for the manufacture of bolts, nuts, rivets and screws. The plant will be a branch of the Pittsburg Screw and Bolt Company, and the Fort Pitt Forge Company, of Pittsburg.

The Cleburne (Tex.) Foundry Company is in the market for the following equipment: One direct connected motor driven pressure blower, one 36-inch cupola, two 10-horsepower alternating-current motors, one 6- or 7-horsepower alternating-current motor, one keyseater, one cold saw.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 28 for 12 numbering machines as per Schedule 2622, 10 microscopical outfits (schedule 2619), 20 mechanical signal hoist outfits (schedule 2621), 12 steam thermometers (schedule 2618), electrical supplies (schedule 2620).

Proposals will be received at the office of supervising architect, Treasury Department, Washington, D. C., until 3 p.m., July 5, for installing new heating apparatus and modifications in plumbing system in the United States court house and postoffice at Rutland, Vt. Drawings and specifications can be had of James Knox Taylor, supervising architect.

The Standard Welding Company, Cleveland, Ohio, has let contract for the construction of a four-story addition to its plant. About $75,000 will be spent on equipment, of which about $10,000 will be for machine tools, including lathes, drill presses, boring mills, shapers. The remainder will be for motors, elevators and special tube and rim machinery.

Henry Disston & Sons, Philadelphia, Penn., who have built several additions to the Keystone Saw, Tool, Steel and File Works, are commencing the erection of another addition to the file department and will soon commence work on a new building to accommodate the machine knife and jobbing departments, also building for cold-rolling department.

The Victor-Balata and Textile Belting Company, which has been formed by German and American belting manufacturers, will erect at once a large plant at Easton, Penn. Chas. E. Aaron and John R. Stein, of the New York Leather Belting Company, are respectively president and treasurer, and Edwin Vollrath, of C. Vollrath & Son, Blankenburgh, Germany, is secretary.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids June 28, for the following: 26,400 pounds steel bolts and nuts (schedule 2627), twist drills, files, hammers, handles, bench vises (schedule 2624), 418 ounces silver anodes, rod platinum (schedule 2620), 10,200 pounds rolled naval brass, 50,000 pounds copper ingot, 3,648 pounds sheet copper (schedule 2625), 11,300 pounds round rod brass (schedule 2623), 53,000 pounds rod rivet steel (schedule 2624), pipe fittings, unions, composition and gate valves (schedule 2626).

Fires

Kokomo Brass Company, Kokomo, Ind. Loss, $20,000.

Union Furniture Company, Rockford, Ill. Loss, $100,000.

Adna Mill Company, Adna, Wash. Sawmill. Loss, $50,000.

Herald Printing Company, Montreal, Canada. Loss, $250,000.

B. Slattery, Ottawa, Canada. Packing plant. $10,000 damage.

The South Fork Lumber Company, North Bend, Wash. Loss, $200,000.

Ames Bending Company, Celina, Ohio. Buggy bow works. Loss, $35,000.

Scholey Brothers Planing Mills, Toronto, Ont. $5000 damage to machinery.

Edward D. Snyder Flour and Cider Mill, Williamsville, N. Y. Loss, $20,000.

Homestead Mine, Platteville, Wis. Plant destroyed. Loss, $25,000 to $30,000.

Hill Box Manufacturing Company, Quebec, Canada. Partially burned. Loss, $8000.

H. Cargill & Son, Cargill, Ont. Heading mill, power and pump house. Loss, $50,000.

Schulenberg Brothers, Hudson, Wis. Cold-storage plant and creamery. Los, $25,000.

Greenville Mattress Factory, Abe Lowenstein's Iron and Metal Works, Greenville, Tex. Loss, $10,000.

Western Chemical Manufacturing Company, Denver, Colo. Sulphuric acid plant destroyed and other buildings damaged. Loss, $225,000.

Kenwood Power building, Cleveland, Ohio. Completely destroyed. Firms burned out were American Plating Company, Cleveland Steel Tool Company, Adams Wheel Manufacturing Company, Fraser Manufacturing Company, Peerless Automatic Company, Wire Goods Manufacturing Company.

New Incorporations

Smith Motor Company, Terre Haute, Ind. Manufacture auto parts. Capital, $25,000. Incorporators, W. B. Smith, E. B. Smith.

Illinois Valley Gas and Electric Company, Streator, Ill. Furnish light and power for 26 towns. Capital, $6,250,000. S. E. Insul, president.

McKinney Traction Cultivator Company, Atlanta, Ga. Manufacture traction cultivators. Capital, $1,000,000. W. J. McKinney, president.

Louis J. Wurth, Inc., Newark, N. J. Manufacture guns, firearms, etc. Capital, $50,000. Incorporators, Louis J. Wurth, Jos. C. Wurth, Edw. A. Wurth.

Federal Wire Company, Newark, N. J. Manufacture wire goods. Capital, $100,000. Incorporators, Gustave Hauseling, G. B. Winship, J. W. Laffey.

Bolton-Myers Auto and Truck Company, Troy, N. Y. Capital, $10,000. Directors, Richard Bolton, George T. Bolton, Cohoes; S. E. Myers, Troy.

Marion Dump Wagon Company, Marion, Ohio. Manufacture dump wagons, etc. Capital, $10,000. Incorporators, H. S. Long, Jay Smiley, Geo. B. Christian, etc.

Bridgeton Paper Box Company, Bridgeton, N. J. Manufacture paper boxes, bags, etc. Capital, $25,000. Incorporators, A. R. Ralph, Louis Sagel, Chas. F. Cox, etc.

Apex Manufacturing Company, Louisville, Ky. Machine and foundry business. Capital, $10,000. Incorporators, Edward H. Stevens, Edw. C. Bender, P. J. Cosgove.

Hunso Machinery Company, Buffalo, N. Y. Manufacture and deal in machinery, etc. Capital, $10,000. Incorporators, W. D. Huntington, R. D. Soars, E. A. Soars.

The Ohio Tile and Brick Company, Lima, Ohio. Manufacture and sell tile, brick, etc. Capital, $100,000. Incorporators, Chas. M. Leech, T. K. Hague, R. T. Betts, etc.

Bliss Plumbing and Supply Company, Rochester, N. Y. Manufacture and deal in plumbing supplies, etc. Capital, $20,000. Incorporators, Chas. H. Bliss, E. Bliss, C. T. Klein.

Finzer Brothers Clay Company, Shanesville, Ohio. Manufacture hollow building tiles, brick, etc. Capital, $10,000. Incorporators, Chas. S. Finzer, Harry A. Finzer, etc.

Ashokan Garage, Kingston, N. Y. Conduct garage, etc. Capital, $10,000. Incorporators, Maurice Deyo, 88 Maiden Lane; Jacob Johnson, 155 Prospect street, Kingston, etc.

Louis F. Payn Box Board Mills, Chatham, N. Y. Manufacture paper, pasteboard, etc. Capital, $100,000. Incorporators, D. Forbes, H. D. Forbes, Brooklyn, N. Y.; E. L. Roe, New York.

Multiple Unit Electric Company, New York. Manufacture electric furnaces, cooking and heating devices. Capital, $100,000. Incorporators, M. N. Kohn, M. M. Riglander, M. Hammond.

Collinsville Electric Company, Collinsville, Ill. Manufacture and sell gas, steam, hot water and electric current. Capital, $100,000. Incorporators, J. J. Fry, A. W. Crawford, E. B. Hess.

Auto Body and Top Company, Cleveland, Ohio. Manufacture automobiles, automobile parts and tops. Capital, $25,000. Incorporators, Guy W. Patterson, E. P. Dowling, C. C. Warden, etc.

Trolley Automatic Lock Company, New York. Manufacture automatic locking devices for trolley poles, etc. Capital, $200,000. Incorporators, J. H. Taylor, A. B. Warwick, A. A. Meeker.

Ohio Klick Churn Company, Columbus, Ohio. Manufacture patented churn and other household articles. Capital, $20,000. Incorporators, David W. Jones, C. A. Gibson, John W. Moore, etc.

Flexible Abrasive Wheel Company, Newark, N. J. Manufacture flexible abrasive wheels, metal and wood-polishing machinery. Capital, $10,000. Incorporators, A. W. Taylor, 512 West One Hundred and Fifty-first street, New York; E. L. Clark, 103 South Thirteenth street, Newark, etc.

Business Items

The Atlas Machine Company, Waterbury, Conn., makers of bench and power presses, spinning and nurling lathes, has erected a new shop on Manhan street to handle its increased business.

William J. Smith Company, New Haven, Conn., manufacturing the one-lock adjustable reamer, announces that its corporate name has been changed to One-Lock Reamer Company. The management will be the same as

for the past 18 months, with Joseph Swift, president; Samuel Swift, secretary and treasurer, and W. B. Gardner, superintendent. To meet the steadily increasing demand for the one-lock reamer, the company has added largely to its manufacturing equipment, and after July 1, 1910, will be established in larger quarters.

FORTHCOMING MEETINGS

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

Society of Automobile Engineers, convention of designers and superintendents, July 28, 29 and 30, Detroit, Mich. H. E. Coffin, president, 1451 Broadway, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

Wanted—Two 36" Fellows gear shapers, late type. Box 619, AMERICAN MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Party with capital and manufacturing facilities wants good machine or device to make and sell. Box 652, AMERICAN MACHINIST.

Anyone wishing early delivery on a new multiple spindle screw machine, communicate with "M." Box 663, AMERICAN MACHINIST.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Mechanical drafting, special machinery designed, tools, dies, fixtures, etc.; charges reasonable. Box 669, AMERICAN MACHINIST.

Light, fine machinery and mechanical specialties built to order; jigs, tools, etc., designed and built. Goodson Electric and Manufacturing Co., Providence, R. I.

Does your gasolene motor run smoothly? If not, send 10c. postage for 56-page textbook on "Carbureters and Engine Troubles." Breeze Carbureter Company, Newark, N. J.

Wanted—Iron planer, second hand, five feet or wider between housings, platen fifteen feet or longer; give particulars, cash price, where can be seen. P. O. Box 2785, Boston, Mass.

Cincinnati shop has some spare capacity and is open to contract work for engine lathes, Jones & Lamson turrets, drill presses, milling machines and grinders. Box 633, AMERICAN MACHINIST.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Wanted—A concern consisting of foundry and machine shop, employing 150 to 200 men, would like to enlarge its business by manufacturing machines for other parties; estimates given. Box 662, AMER. MACHINIST.

Oxygen-acetylene welding of all kinds of metals; crane facilities for handling the heaviest of pieces; we do light work also; our experience and success warrant us in giving a very liberal guarantee covering all of our work. Krajewski-Pesant Company, 52 Beard St., Brooklyn, N. Y.

Machine work wanted; we are in a position to manufacture special or staple articles in connection with our present line. Our facilities are such that we can employ one hundred and fifty men if necessary; our equipment also includes large case-hardening and tempering furnaces. Address H. G. Kotten Co., 30 Church St., New York City.

Machinists' and draftsmen's handbook; second edition, enlarged and revised; over 450 pages, including illustrations and tables for $2.50; from cover to cover it is full of valuable and helpful information; invaluable to the employer as well as the workman; don't send any money; simply send your order and receive the book on trust; look it over—if you like it, keep it; act today. Address Peder Lobben, Box 243, Holyoke, Mass.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

A gentleman with 30 years' business experience, who is personally known to the directors and general managers of all the principal shipbuilding and marine engineering companies in Great Britain, would be willing to act as representative for some responsible firm of American manufacturers, having business in any specialties connected with the shipbuilding industry, auxiliary machinery, etc., etc.; highest references given and required. Replies to "X Y Z," Care of J. W. Vickers & Co., 5 Nicholas Lane, London, E. C., Eng.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A production manager for small tool factory; state experience and salary expected. Box 618, AMERICAN MACHINIST.

Wanted—Foreman for brass finishing department in large electrical factory. Apply, stating experience, Canadian General Electric Co., Peterboro, Ontario.

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Peterboro, Ont.

Wanted — First-class toolmakers on automobile jig and fixture work; highest wages paid to first-class men; no others need apply. Reo Motor Car Co. of Canada, Ltd., St. Catharines, Ont., Canada.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—Several first-class diemakers and toolmakers on light work; also machinists accustomed to light work; steady work and good pay for good man. Address Post Office Box 87, Station "A," Hartford, Conn.

Wanted—Salesmen to handle on a generous commission basis, a well advertising and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," AMERICAN MACHINIST.

ILLINOIS

Wanted—Tool designers; state age, salary, experience. The Buda Company, Harvey, Ill.

Wanted—Draftsman, experienced in automobile design, particularly motor and transmission; must be competent to check drawings; state age, salary, experience, etc. The Buda Company, Harvey, Ill.

Wanted—Chief draftsman in factory of special machinery, employing 300 men; must be man of thorough practical shop experience, as well as expert technical training, and of executive ability and experience to systematize work in drafting room, accurately check drawings and keep records; excellent permanent position for high-grade man. Box 661, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A first-class draftsman familiar with wood car detail. Box 621, AMER. MACH.

Wanted—Toolmakers, experienced on punch and die work. Apply Employment Department, General Electric Co., Pittsfield, Mass.

Draftsman Wanted—Experienced mechanical draftsman and designer on steam turbine and electrical work for permanent position; state age, education, experience and salary expected by addressing, Chief Draftsman, General Electric Co., Lynn, Mass.

Wanted—A thoroughly competent machine designer with inventive faculty and thorough knowledge of modern shop practice to work on special line of machinery. Apply by letter only, giving age, experience, reference and salary desired, to Room 809, 318 Main St., Springfield, Mass.

MICHIGAN

Wanted—A few first-class toolmakers experienced on die, jig and fixture work for light manufacturing. Box 592, AM. MACH.

Wanted—Immediately, first-class metal patternmakers, tool and jig makers; give reference and experience; steady work. Holm's Machine Mfg. Co., Sparta, Mich.

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—First-class mechanic, uptodate in getting out production, as assistant superintendent; one who has held similar position, for a large automobile parts company; good position for right man; give references and experience. Box 651, AMERICAN MACHINIST.

Wanted—Tool room foreman to take care of tool room employing about 12 toolmakers; must be experienced with tools for sheet-metal work, capable of designing dies, jigs, etc., for small interchangeable work; answers kept in confidence. Address, stating age, experience and salary expected. Box 615, AMER. MACH.

MISSOURI

Wanted— Inspector on close, accurate machine work for a large electrical concern in the West. Box 659, AMERICAN MACHINIST.

Wanted—Chief draftsman with technical engineering training, with machine shop and foundry experience, able to produce economical results. Curtis & Co. Mfg. Co., St. Louis.

Wanted—Chief inspector; one familiar with steel bolsters and car work by large steel plant in West; one with car building experience preferred; give references and experience. Box 576, AMERICAN MACHINIST.

Wanted—A first-class foreman to take charge of machine shop of a western plant manufacturing gas engines and agricultural machinery; must be up to date in shop practice and experienced in handling men; give references. Box 670, AMERICAN MACHINIST.

NEW JERSEY

Draftsman and engineer wanted; one thoroughly familiar with large steam power house installation; several months' work. Address Box 387, Perth Amboy, N. J.

NEW YORK

Wanted—First-class tool draftsmen; only those with experience need apply. Mergen-

thaler Linotype Company, 20 Ryerson St., Brooklyn.

Wanted—A few first-class toolmakers on small accurate work; good wages and steady employment to competent men. Bundy Mfg. Co., Endicott, N. Y.

Wanted—Foreman for tool department and tool makers; state qualifications and rate wanted in first letter. The Kirkham Motor Mfg. Co., Bath, N. Y.

Wanted—Foreman by a large manufacturer of ice machines; good wages and steady work to a thoroughly competent man; state age, experience and wages expected. Box 665, AMERICAN MACHINIST.

Wanted—A foreman for machine shop, employing fifteen to twenty-five men; building machine tools; must be capable of taking entire charge and produce results; location western New York. Address "Tools," AM. M.

Agencies wanted for Northwest; live concern of engineers with New York office desire electrical and mechanical apparatus and specialties; rare opportunity to establish your products in growing territory without expense. Box 655, AMERICAN MACHINIST.

Wanted—Machinists who have had experience in setting up automatic screw machines, in a department composed of Acme, Gridley multiple and single, and Cleveland machines; on a line of very accurate work; when replying, state experience, wages expected, etc. "Automatic," Box 629, AMER. MACHINIST.

Wanted—Tool steel salesman, New York district; one who understands hardening and tempering of carbon steel and high-speed steel; also machine shop work; apply only by letter, stating experience and salary required; communications confidential. Wheelock, Lovejoy & Co., 23 Cliff St., New York.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Foreman for automatic screw machine department on a line of high class, automobile work; operating Cleveland, Acme and Gridley machines; must have had experience as a foreman on this line of work; when replying, state age, experience, where employed for the past five years, and in what capacity, wages expected to start with, and date on which applicant would report for work; all replies will be treated confidentially. "Foreman," Box 628, AMER. MACH.

OHIO

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Draftsmen familiar with detail crane design; state wages desired. The Toledo Massillon Bridge Co., Toledo, Ohio.

Expert salesman wanted by the Defiance Machine Works, of Defiance, Ohio; must be thoroughly familiar with the general woodworking trade in the United States; one conversant with wheel and wagon manufacturing preferred; applicants should be under middle age and able to give first-class references; a good position for a high-class man.

Superintendent—A business, employing 500 men, consisting of pattern, foundry and machine shop, manufacturing medium heavy machinery, desires superintendent with thorough knowledge of foundry and machine business; man must be systematic, and have held successfully position of superintendent in a modern organization; good salary and future with an expanding company; only men of ability need apply; location northern Ohio. Box 650, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Lathe, boring mill and floor hands; good wages, steady work. The Blaisdell Machinery Company, Bradford, Pa.

Wanted—Competent inspector for automobile parts. Apply, Merchant & Evans Co., Mechanical Department, 21st & Washington Ave., Philadelphia, Pa.

Wanted—Three first-class draftsmen on jigs and fixtures; none but first-class men need apply; state references, experience and salary expected. Lycoming Foundry & Machine Co., Williamsport, Pa.

Wanted—Jig and tool draftsmen accustomed to automobile work. Reply, giving experience, age and salary expected. Box 645, AMERICAN MACHINIST.

Machinists — Machine operators wanted; plenty of work, nothing but sober and steady men need apply. Standard Engineering Company, Ellwood City, Pa.

Toolmakers—Seven first-class toolmakers on jigs and fixtures; permanent employment. Apply, with references, to Lycoming Foundry & Machine Co., Williamsport, Penn.

Wanted—Good all-around toolmaker, experienced on die work. Apply by letter only, and state where last employed, and how long. The Blue Ridge Metal Mfg. Co., Susquehanna, Penn.

Wanted—Two experienced checkers and two experienced structural draftsmen wanted by a large firm, on mill buildings, etc.; location, eastern Pennsylvania. Write, giving age, nationality, education, experience and salary expected. Box 660, AMER. MACHINIST.

We are increasing our force and invite applications from machine hands of all kinds, including men who can turn multiple throw cranks, bench hands, erectors, metal polishers, and Jones & Lamson turret lathe hands; shop located near Philadelphia and building marine gas engines; no labor troubles; give experience in detail. Box 591, AM. MACH.

Machine shop foreman wanted for foundry and machine shop; must have had some experience in machine tool building and in general repairs; shop employs about 40 hands and is situated in Pennsylvania, in the Schuylkill valley; give full particulars referring to recent employers, giving experience, age and salary expected; replies will be treated confidentially. Box 664, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—An experienced draftsman for detail work on special machines. Box 654, AMERICAN MACHINIST.

Wanted—General superintendent for manufacturing concern; must be familiar with modern machine shop practice and have good executive ability; state age, experience, references and salary expected. Box 653, AM. M.

WISCONSIN

Shop man who understands the rapid and accurate production of small, interchangeable parts, and who has a good knowledge of production of stampings; must be sober, energetic and good mechanic; state age, experience, salary expected, where employed at present, and reasons for desiring a change. "X. Y. Z." AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted—A few agencies for Canada or the Province of Quebec by a salesman, fifteen years' experience in pumps, boilers, engines and machinery; would confine himself to one line. Box 346, AMERICAN MACHINIST.

CONNECTICUT

Position wanted by mechanical engineer, to take charge of experimental department; good inventor; specialist on typewriter, adding machines. Address A. W. Clauder, 43 Wordin Ave., Bridgeport, Conn.

A production man with extensive and valuable experience in the manufacture of medium sized machinery, and also thoroughly familiar with bonus and piece-work methods, desires a situation as production or assistant mechanical superintendent; location desired, New England or Middle Atlantic States. Box 667, AMERICAN MACHINIST.

Wanted—Position as superintendent, assistant, mechanical engineer or to take charge of high-grade experimental work; 14 years' experience with well known typewriter company; good inventor; able to design and build any model, tools and automatic machine; well posted on manufacturing and assembling of typewriters or similar machines; best of references given. Box 666, AMER. MACH.

ILLINOIS

Experienced, practical, systematic superintendent in charge of a large manufacturing plant, wishes to make a change. Box 641, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 608, AMER. MACH.

NEW JERSEY

Foreman wishes position in machine shop or auto repair shop; well experienced; good references. Box 657, AMERICAN MACHINIST.

NEW YORK

General foreman, 39, up to date in modern methods of manufacture, now employed, desires change; good reference. Box 626, AM. M.

Brown & Sharpe automatic screw machine hand; 25; 7 years' auto experience; can design own cams, etc.; capable of taking charge, desires change. Box 648, AMER. MACHINIST.

Toolmaker, 26, 10 years' experience on subpress dies, jigs, fixtures and gages for accurate production, desires position with uptodate firm on close work. Box 649, AM. MA.

Mechanical engineer, wide general experience, marine engines, valves, steam turbines and mill work, shop and drawing office, technical graduate, desires change. Box 658, AMERICAN MACHINIST.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 640, AMERICAN MACHINIST.

Mechanical engineer and draftsman, five years' shops, four years' drafting, broad experience, ingenious and executive abilities, desires responsible position, preferably with consulting engineer in New York; age 25; excellent references. Box 668, AMER. MACH.

Works manager, general superintendent, or mechanical engineer; 20 years' experience in all grades of shops and office work; thoroughly familiar with cost keeping, estimating, correspondence, office business practice; qualified to take entire charge; technically educated, experienced designer, first-class executive. Box 624, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—Situation as superintendent or general foreman by a first-class practical mechanic holding similar position for eleven years; have a thorough knowledge of best machine shop and foundry practice; can get maximum production from men and equipment; good systematizer, accustomed to large works; good reason for changing; references furnished. Box 627, AMERICAN MACHINIST.

WISCONSIN

Superintendent wants position; high grade mechanic and executive; wide experience in designing, perfecting and developing special automatic machinery; past four years in present position; salary $3000. Box 616, AMERICAN MACHINIST.

Cost accountant, young man, 33, twelve years' shop and office experience; thoroughly familiar with uptodate methods, and competent to devise and take charge of suitable system, including scientific distribution of burden, monthly statement and proof of accuracy; prefer location in Middle West in shop employing up to 600 men. Box 656, AMERICAN MACHINIST.

Mechanical engineer, technical graduate, desires change; experienced in stationary, portable and traction gas engine design and construction; expert on hoists, bridge and turntable machinery; thoroughly practical and uptodate; good systematizer, able to handle men and get results; would consider position as chief draftsman, experimental engineer or assistant superintendent. Box 647, AMERICAN MACHINIST.

FOR SALE

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; good opening for manufacturing business. Geo. H. Church, Bergen, N. Y.

For Immediate Sale—Two 26" Gisholt turret lathes, latest type, in perfect condition, fully equipped with all adjustments; one of them is a new machine which has been in use but a few months; special spindle in one takes in 5" stock, the other is standard. Standard Roller Bearing Co., Philadelphia, Pa.

For Sale—One Nash gas engine, 20 horse power, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 6 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Ridgs Ericsson Engine Co., 35 Warren St., New York.

High Power Drilling Machines

Editorial Correspondence

A machine designed for high duty and rapid work.

A series of tests which point some lessons in more economical speeds and feeds in drilling.

Convenient control of speeds and feeds an important feature.

The illustrations show a new drilling machine built by the Colburn Machine Tool Company, Franklin, Penn., as equipped with a 25-horsepower Westinghouse motor. Power is transmitted through the speed box, which is between the driving pulley and the columns of the machine itself, and carries all gearing necessary to obtain eight spindle speeds in an oil bath in which all bearings have positive lubrication. All speed changes are made by two levers at the front of the machine. Coming through the speed box the drive goes to the upright shaft and from here by spur gears to the drilling spindle itself. The large gears at the top of the machine are 10 inches in diameter.

The drilling spindle is 2½ inches in diameter in the sleeve, and has a nose 3 13/16 inches in diameter, carrying a No. 5 Morse taper. The spindle speed varies from 45 to 520 per minute with a speed of 500 revolutions of the driving pulley. The spindle has a power feed of 16 inches, while the table has a vertical adjustment of 15 inches, and a working surface of 18x24 inches. The center of the spindle is 12½ inches from the face of the column.

There are six feed changes, all of which are obtained by gearing running in an oil-tight box, changes being made by means of a dive key, and back gears. These feeds run in geometrical progression from point 0.009 to 0.06 inch per revolution of the spindle. The direct feed on the spindle is obtained through a large worm gear, which carries a graduated dial and pawl, which provides an automatic trip for the feed. As these graduations are about ⅛ inch apart on the dial, it is very easy to estimate distances between them and secure much finer readings. The feed may also be tripped by hand from the operator's position at any time, and a safety shearing pin is placed on the worm shaft to protect the speeding mechanism from injury.

When desired, a special knee can be furnished having a compound table with a longitudinal movement of 14 inches and a cross movement of eight inches. This has a working surface of 16x30 inches and contains two large T-slots running lengthwise. It is so designed that all lubricant used on the drills is carried back to the reservoir regardless of the position of the table.

The machine can be operated from either side by lever *A* or *B*, which controls the friction in the driving pulley. Lever *Z*, at the left-hand side, operates the back gears in the speed box. The dive keys which give four of the eight changes of speed in the speed box, are controlled by handle *Y*, which is shown moved into the fourth or *D* position.

The feed changes are controlled by pull shaft *W* in connection with the pull

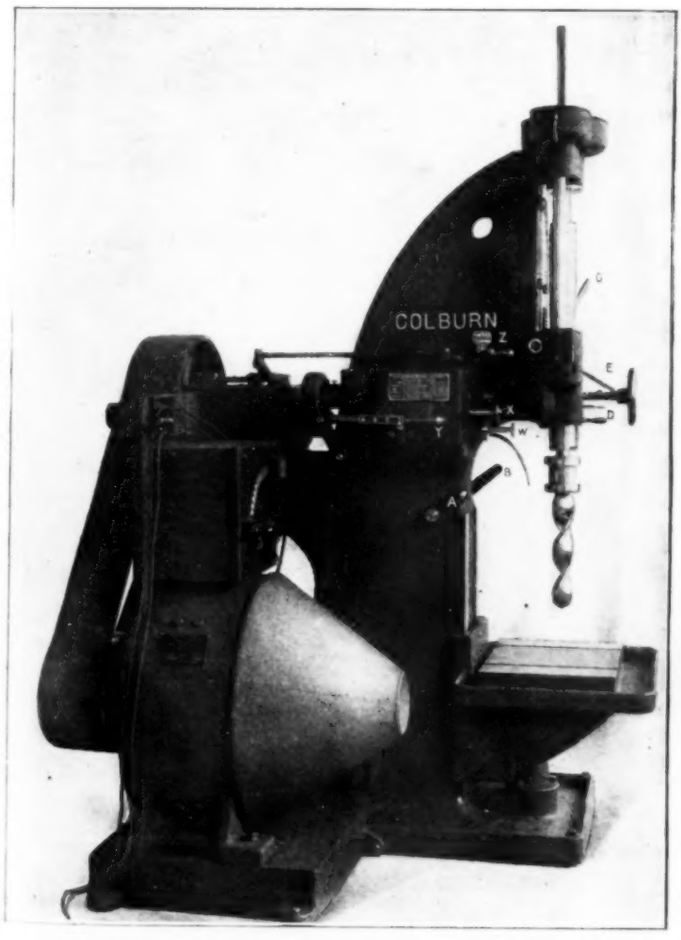


FIG. 1. MOTOR-DRIVEN 24-INCH COLBURN DRILLING MACHINE

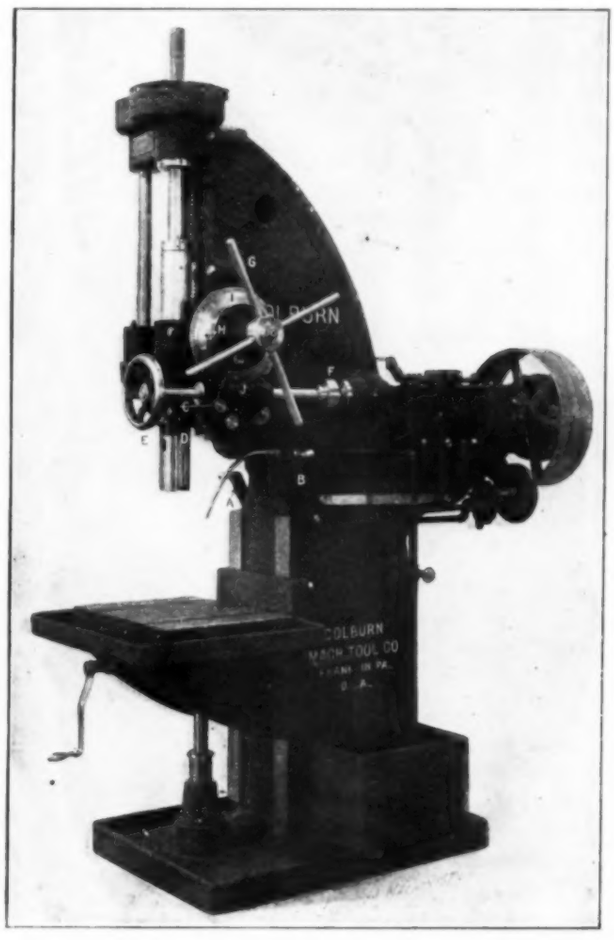


FIG. 2. THE OTHER SIDE OF THE MACHINE

shaft *X*, which controls the back gears for the feed, both together giving six changes. Lever *C* is the hand trip for the feed, while *D* throws the feed in after being tripped. Handwheel *E* disengages the power feed by pulling out the clutch *F*, after which the hand feed can be operated through the worm. Handle *G* controls the rapid traverse after the worm and gears are disengaged by throwing the lever *C*. The dial *I* is graduated so as to show 1/32 inch of spindle travel, one revolution representing seven inches. The pawl *H*, however, is so designed that

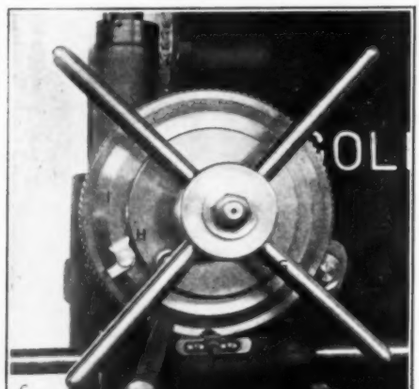


FIG. 3. AUTOMATIC TRIPPING DEVICE

it can be set to allow two revolutions before tripping, and in this way it may be used for feeding any depth up to 14 inches. This pawl is readily adjustable and the feed may be tripped at any point desired, as well as the depth of the hole read at a glance. The graduations on the dial are read from the adjustable pointers *J*. A substantial oil pump is part of the machine, being fitted so as to be out of the way and yet easily accessible.

TESTS WITH CELFOR DRILLS

The following tests show results recently obtained with the new Colburn drilling machine and Celfor high-speed twisted drills. The tests will bear considerable study and should help to show that in many places drills are being run far below the economical point. We should not, however, forget that the nature of the work is often the limiting factor rather than the drill or the machine.

The tables show that it is easily possible to run high-speed drills as high as 200 feet per minute cutting speed on cast iron, although 125 to 150 feet per minute seem to have been used in most cases. When we consider the chip of 0.06 inch being removed for each revolution of the drill at the speeds shown, we begin to realize that the drill is capable of more work than we used to think possible.

It will also be noticed that there was no attempt to drive the drill to destruction, but to see what production could be secured without injury to either the drill of the machine itself. At the Atlantic City convention of the American Railway Master Mechanics' Association this machine was seen day after day on similar tests. A 2½-inch drill was driven 11½ inches a minute through cast iron while a 1⅛-inch drill was fed at the rate of 31.2 inches per minute in the same material; this means 520 revolutions per minute and a feed of 0.06 inch per revolution.

Test No.	Size of Drill.	R.P.M. of Drill.	Feed per Revolution.	Material.	Cutting Speed, Feet per Minute.	Inches Drilled per Minute.	Thickness of Block, Drilled Inches.
1	1	520	0.060	C.I.	134	31.2	4
2	1¼	520	0.060	C.I.	169	31.2	4
3	1⅜	520	0.060	C.I.	186	31.2	4
4	1½	520	0.060	C.I.	203	31.2	4
5	1¾	370	0.060	C.I.	169	22.2	4
6	3	140	0.041	C.I.	109	5.75	4
7	3	140	0.060	C.I.	109	5.4	4
8	3	188	0.060	C.I.	147	11.25	4
9	1¼	370	0.019	Steel	120	7	4
10	1¼	370	0.028	Steel	120	10.4	4
11	1½	262	0.019	Steel	102	5	4
12	1½	262	0.028	Steel	102	7.3	4
13	1½	262	0.041	Steel	102	10.75	4
14	1¾	188	0.028	Steel	86	5.25	4
15	1¾	188	0.041	Steel	86	7.71	4
16	2½	140	0.028	Steel	91	3.9	4
17	3	100	0.028	Steel	78	2.8	4
18	3	100	0.041	Steel	78	4.1	4

TABLE 1.

In all the tests above recorded the drills were in good condition after drilling the holes. Some faster records were made for short distances only, but the drills were burnt or broken, and these tests are not recorded in the table above.

Analysis of cast iron drilled was as follows:

Silicon	2.94	Combined carbon	0.15
Manganese	0.60	Phosphorus	0.446
Graphitic carbon	3.17	Sulphur	0.080

TEST MADE MAY 31, 1910.

Test No.	Size of Drill.	R.P.M. of Drill.	Feed per Revolution.	Inches Drilled per Minute.	Cutting Speed, Feet.	Remarks.
1	1	520	0.060	31.2	134	Drill in good shape.
2	1¼	520	0.060	31.2	169	Drill in good shape.
3	1⅜	520	0.060	31.2	186	Drill in good shape.
4	1½	520	0.060	31.2	203	Drill in good shape.
5	1¾	520	0.060	31.2	238	Drill burnt at corners.
6	17/64	520	0.060	31.2	123	Drill in good shape.
7	2	370	0.060	22.2	191	Drilled 2 inches. Fuse blew out.
8	3/4	520	0.060	31.2	99	Drill in good shape
9	3/4	520	0.028	14.5	69	Drill in good shape
10	3/4	520	0.060	31.2	99	Drill in good shape.
11	1 5/16	520	0.060	31.2	143	Drill in good shape.
12	1 5/16	520	0.060	31.2	143	Drill in good shape.
13	1⅛	520	0.060	31.2	151	Drill in good shape.
14	1¼	370	0.060	22.2	120	Drill in good shape.
15	3	140	0.041	5.75	109	Drill in good shape.
16	3	140	0.060	8.4	109	Drill in good shape.
17	3	188	0.060	11.25	147	Drill in good shape.
18	3	262	0.060	15.75	205	Drilled 3" and blew out. Drill in good shape.

TABLE 2.

All the above drilling was done in cast-iron blocks 4 inches thick.

Analysis of iron was as follows:

Silicon	2.94	Combined carbon	0.15
Manganese	0.60	Phosphorus	0.446
Graphitic carbon	3.17	Sulphur	0.080

Test No.	Size of Drill.	R.P.M. of Drill.	Feed per Revolution.	Inches Drilled per Minute.	Cutting Speed.
1	1	520	0.060	31.2	134
2	1¼	370	0.060	22.2	120
3	1⅜	262	0.060	15.72	102
4	1¾	262	0.060	15.72	120
5	2	188	0.060	11.25	97
6	2	188	0.060	11.25	97
7	2¼	140	0.060	8.4	91
8	3	140	0.060	8.4	109

TABLE 3.

All the above drilling was done in cast-iron blocks 3 inches thick.

Analysis of iron was as follows:

Silicon	1.88	Combined carbon	0.42
Manganese	0.47	Phosphorus	0.582
Graphitic carbon	3.08	Sulphur	0.107

Making Aluminum Gas Tips

Editorial Correspondence

Aluminum gas tips are blanked, drawn up to length, stamped on the sides, pierced and formed at the end, and then tapered to fit the burners, in a V. & O. power press equipped with dial feed.

Details of the machine, the tool equipment and the progress of the work through the dies.

The aluminum gas tip is a household appliance familiar to all mechanics and the method of manufacturing this little article should therefore be of interest to them. It is obviously a punch-press job and Fig. 1 illustrates a press built by the V. & O. Press Company, Glendale, L. I., equipped with tools for the production of this piece.

The Machine and Tools

The press used is of the same type as illustrated in the article by W. J. Kaup, at page 1086, Volume 32, Part 2, the article referred to showing the press as set up for the manufacture of a peculiar bottle cap. In the making of the aluminum tips there are seven operations performed in this press, the sequence being shown in Fig. 2.

At the right-hand side of the press ram is mounted an inverted combination die which accomplishes the cutting of the blank and the forming of the cup, which, when pressed down into the feed dial below is then carried to the first redrawing punch, which extends the cup *A*, Fig. 2, to the length indicated at *B*. The next punch and dies are redrawing tools which lengthen the shell as at *C*, and the fourth punch and die shorten the piece slightly as at *D* by compressing it from the end for the purpose of truing up the edge and removing the irregularities left by the redrawing die.

The fifth die stamps the characters in the side of the tips, as indicated at *E*, and the next stroke carries the work into the sixth die where the small hole in the tip *F* is pierced, this hole, of course, being varied in size by interchangeable dies for different rates of consumption of gas by the tip; that is, giving an area for say, three, four, five or six feet consumption per hour. The seventh, or final, die in the series tapers the body slightly from the rear so that it will enter the burner readily and squeezes in the opposite sides of the tip; the completed piece then appears as shown at *G*. The eighth punch, carried at the left-hand side of the ram, is merely an ejecting device to push the work down through the press, causing it to fall into a box beneath. The scrap from the small hole is carried off by an independent chute and is thus separated from the finished product.

The Stock Feed and Dial

The sheet aluminum used is about 1/64 inch thick and is fed to the first tools by a roll feed shown at the right-hand side of the machine. As the dial is indexed, step by step, carrying the work over the series of dies and under the corresponding punches, it is necessary that the piece should be held central with the receiving hole in the dial in order that it may enter properly in the die beneath. To accomplish this, three spring plugs arranged as indicated in Fig. 3, are provided for each dial opening.

The dial is bored out considerably larger than the work it is to carry, and steel bushings are pressed into place, each of these bushings carrying three of the spring plugs referred to. These plugs are machined at their inner ends to conform approximately to the curvature of the work, and the spring pressure, while light enough to admit the work freely between the ends of the plugs, is sufficient to hold the piece steadily while it is being transferred to successive positions. The punches in most cases have spring actuated plungers which enter the work in advance of the punch proper, thus holding it securely in its seat until the punch comes into action.

The Marking Die

The construction of the die for stamping the characters in the side of the work is indicated in Fig. 4, which illustrates the principle of operation clearly. This die is made up of four jaws tapered externally to fit into a conical seat in their receiving ring and having raised figures

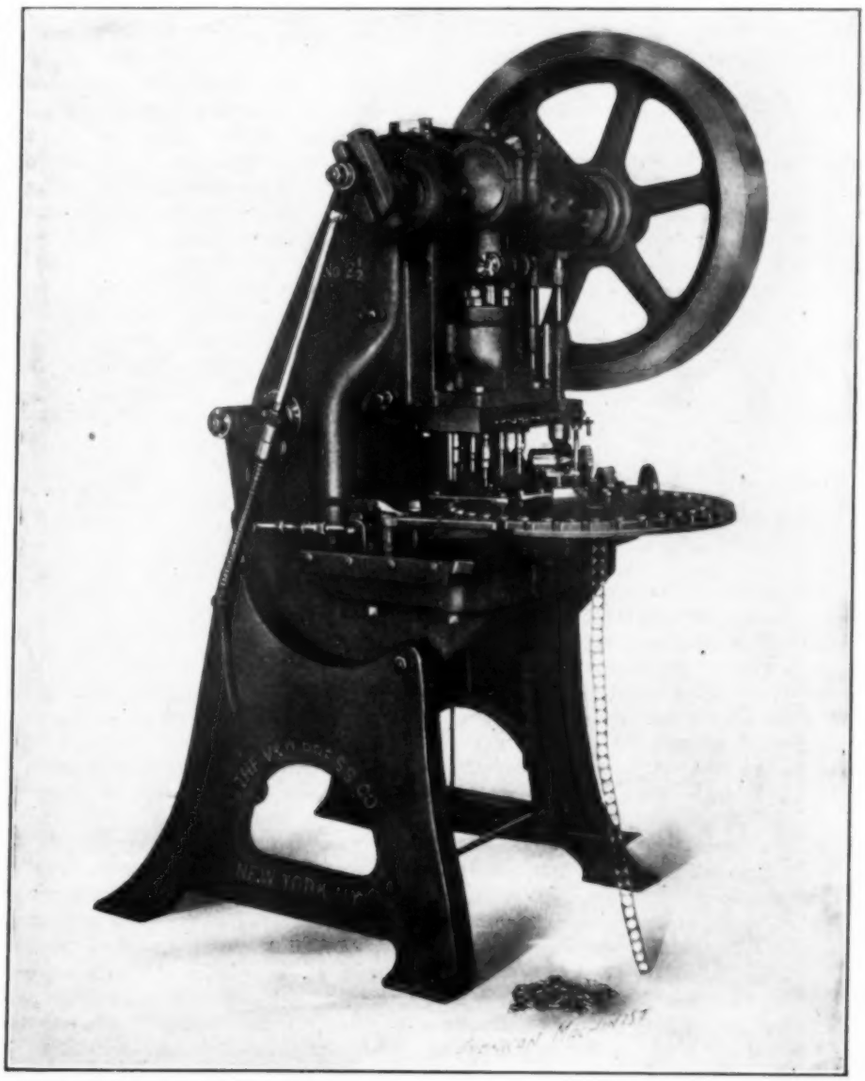


Fig. 1. V. & O. Press Equipped for Manufacturing Aluminum Gas Tips

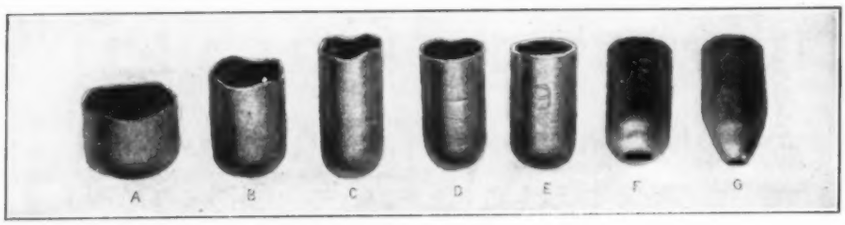


FIG. 2. SUCCESSIVE OPERATIONS IN MAKING THE ALUMINUM GAS TIP

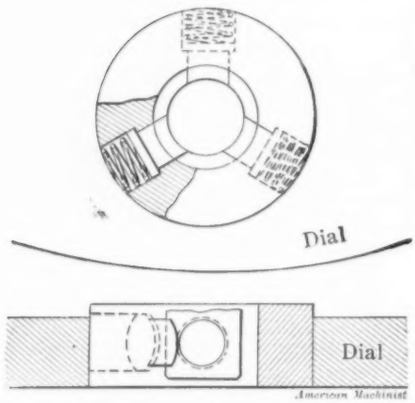
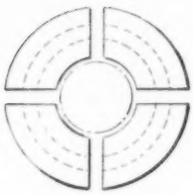


FIG. 3. CENTERING DEVICE FOR DIAL FEED WITH GAS-TIP CAP IN POSITION

and other characters engraved upon their concave inner surfaces. The four sections are lifted slightly from their lowermost position in the receiver, and when the aluminum tip is forced down into the die jaws by the corresponding punch the work and jaws are carried down together and the jaws are closed tight in their taper seat against the aluminum shell, forcing the characters in the die into the metal tip. During this operation the steel is supported from the inside by the punch. Upon the up stroke of the ram the stamped tip is carried back into the feed dial and the four sections of the stamping die are pressed upward sufficiently by a plunger beneath to open them for the ejection of the tip just stamped, and the reception of the next tip.

FEATURES OF PRESS DESIGN

After the first blank has been fed, step by step, under the complete series of punches and emerges in finished form, each stroke of the press completes a tip, all operations being simultaneous. The arrangement at the left-hand side of the press for rotating the feed dial, and the safety stop at the right-hand side are clearly shown in the halftone, Fig. 1. As described in Mr. Kaup's article, the tension of the spring on the oblique operating rod at the left-hand side accomplishes the feeding of the dial, and should the latter become clogged and not advance to its proper position, the press could make a complete revolution without injury to any of the tools or operating levers, as the spring is long enough to compress sufficiently to permit the driving wheel to turn freely without movement of rocker arm and pawl slide.



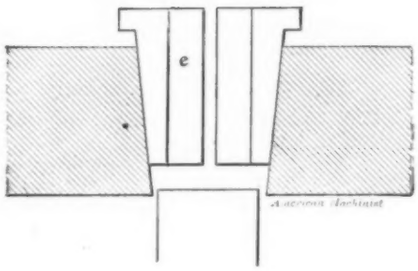


FIG. 4. DIE FOR STAMPING CHARACTERS IN SIDE OF GAS TIP

The safety device at the right-hand side is a spring-controlled plunger which fits into the receiving holes in the feed dial when the latter is perfectly alined with the punches. In the event of the dial not moving to the exact position for any reason whatsoever, the spring pin strikes upon the face of the dial and the upper end of the plunger controlled by this pin then engages with an extension lug upon the driving clutch, disengaging the latter and allowing the driving wheel to run free, thus throwing the press out of action before any of the punches can strike the dial.

Handling Drawings for Consultation

By J. F. Hobart

Sometimes the draftsman finds life has been made miserable for him by the necessity of having anywhere from ten to fifty drawings at hand for reference. Many drafting rooms are so crowded that there is no room for reference tables and the poor draftsman must get along as best he can with the reference sheets in a pile in a drawer, or tumbled upon a chair.

I have several times been forced to work under like conditions and have become accustomed to working all sorts of makeshifts in order to save hands and patience. In cases where the drawing board adjoins a wall, procure a paper of stout needles from a five-cent store and drive the needles into the wall convenient to the working position. Press a drawing over the projecting end of a needle in such a manner that the steel will pierce the upper right-hand corner of the sheet. The drawing will hang diagonally downward and may be consulted easily to a certain extent without removing it from the wall. But when close inspection is necessary, it is easily removed from its needle and laid upon the drawing board —and as easily replaced.

Sometimes the drafting room "god" is so finicky that he kicks about the minute needle hole in the drawing—a hole which is close to the margin and does no harm whatever. In such cases, obtain a box of gummed cloth clips with a small wire eye projecting from the cloth. Moisten this affair and press it upon the back of the drawing and use it for hanging from the needle. When done with the drawing, the cloth hanger can be easily peeled off without leaving a mark. This works well except on tracings. With those, fasten a bit of cardboard upon one corner—the upper right—with two or more Niagara clips and make a hole in the cardboard for the needle.

When it is necessary to take many and complicated measurements from a pencil drawing, and there is no reference table convenient to the board, then just stretch a line overhead, hunt up a couple of patent clothespins or acquire a couple of stop clips for rubber tubing from the laboratory, hang the drawing right over the board, and go ahead with the dimension wrangling. If nothing better can be obtained, stick a couple of pins through the string and bend them into hooks upon which the drawing is to be hung while in use.

Tests of Cast Iron Riveter Frames*

By A. Lewis Jenkins†

Experiments made on test specimens of different shapes and proportions, tending to show that the usual beam formula gives results, which, while approximate, represent actual conditions more nearly than other formulas.

*Condensed from paper read at the June meeting of the American Society of Mechanical Engineers.

†Assistant professor of mechanical engineering at the University of Cincinnati, Ohio.

For many years engineers have recognized the value of experimental data on the strength of cast-iron beams and a considerable volume of literature on this subject is now available. There are, however, no published data on the strength of curved beams similar in shape to punch frames. The results of some experiments on the strength of crane hooks published on page 615, Volume 32, Part 2, of the AMERICAN MACHINIST, seem to show that the Pearson-Andrews formula is true within the elastic limit for steel specimens of small throat depth. It will be noticed, however, that the value used for Poisson's ratio does not compare favorably with the values of this constant usually given for steel.

In view of the fact that there seems to be no rational method for determining the strength of curved cast-iron beams the writer believes that some experimental data on this subject may be of practical value and also serve as an incentive for further investigation by others.

Three forms of test specimens, as shown in Figs. 1, 2 and 3 were used for these tests. These specimens were carefully designed with a view to having them of equal strength throughout, the calculations being based on the ordinary formulas for beams. To prevent any torsional moment due to eccentric loading the specimens were provided with two small hemispherical projections for receiving the load. A round and a rectangular test bar were cast with each specimen as shown in Fig. 6. The castings were made by the Buckeye Foundry Company, of Cincinnati, and poured from a heat run to cast lathe beds.

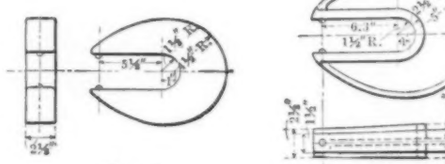


FIG. 1

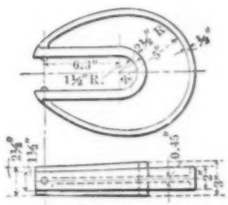


FIG. 2

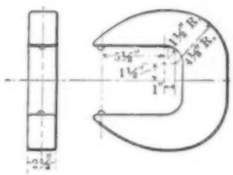


FIG. 3

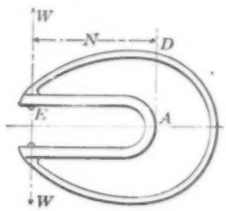


FIG. 4

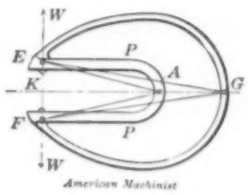


FIG. 5

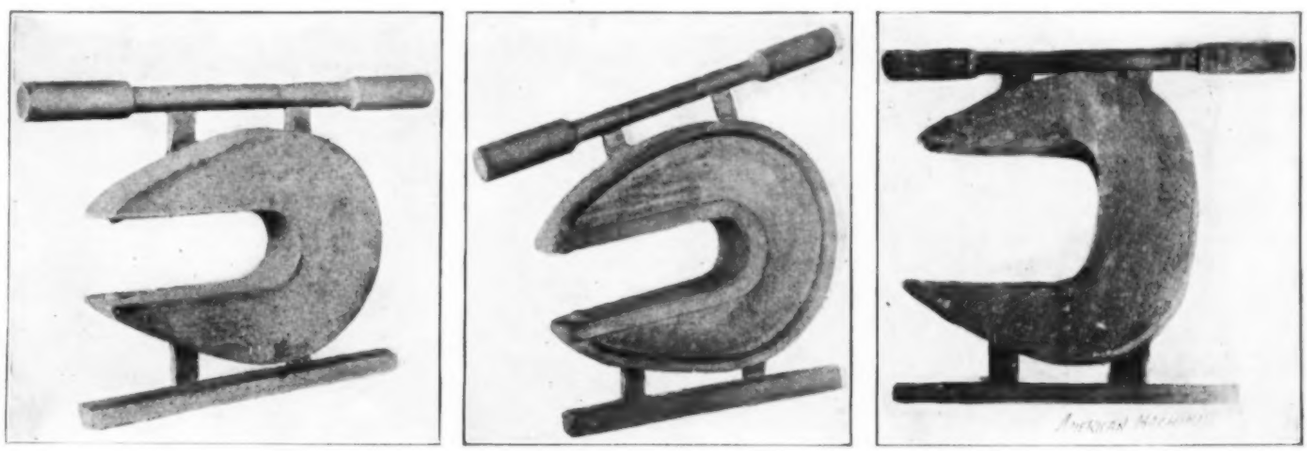


FIG. 6. ROUND AND RECTANGULAR TEST BARS CAST WITH EACH SPECIMEN

RESULTS OF TESTS

Results of the tests are given in the table. The unit tensile strength of the test bars varied from 18,600 to 24,400 pounds, and the flexural strength varied from 36,400 to 46,400 pounds. The variations in the value of K seem to indicate that no definite relation exists between the tensile and flexural strength of small test bars.

The determination of the correct value for the radius of curvature of the gravity axis is extremely important and considerable care was exercised in attempting to get accurate measurements of these values by plotting the curve of the gravity axis and finding its radius of curvature at the section considered in each case. It is possible for the personal equation to cause sufficient variations in these values to affect appreciably the final results. The chances for errors in plotting the transformed curves and measuring their areas is also worthy of the designer's consideration in choosing a formula.

The average dimensions of castings No. 1, 2 and 3, Fig. 8, cast from the same pattern, are given in Fig. 1. Each casting was carefully measured and the values used in the respective calculations. The average tensile strength of the three test bars is 18,907 pounds per square inch. The maximum stress in the castings at failure as given by the beam formula is 14.2 per cent. less than the tensile strength of the test bar, whereas the stress, according to the Résal and Pearson-Andrews formulas is 43.4 per cent. and 75.4 per cent. in excess of the strength of the test bar.

From Keep's experiments it is known that the unit strength of cast-iron bars of the same composition decreases as the area increases; hence, it is reasonable to suppose that the unit stress given by the beam formula is very close to the actual ultimate strength of the material.

The absurd results given by the Résal and Pearson-Andrews formulas in this case show that they are not applicable to this condition.

Castings Nos. 4, 5, 7, 9 and 12, Fig. 8, were cast from the same pattern and the average dimensions are given in Fig. 2. None of the above mentioned formulas apply to these castings, owing to the peculiar manner in which they failed. The results, however, have an extremely important bearing on the design of punch frames. These specimens were supposed to fail under a load of about 15,000 pounds. When the load on No. 4 reached 9300 pounds a fracture occurred behind the inner flange, as shown in the halftones of castings Nos. 7 and 12. Continued application of the load produced the fractures shown on Nos. 4, 5 and 9. The stress producing failure was evidently a normal stress as there is no shear on this section.

The conditions of stress that would produce such a failure may be given as follows:

(*a*) The inner flange being heavier than the web would tend to produce separation behind the flange due to unequal contraction when cooling. This initial stress due to cooling, plus the stress due to lateral contraction caused by the tensile stress due to bending, is a stress normal to the plane of fracture.

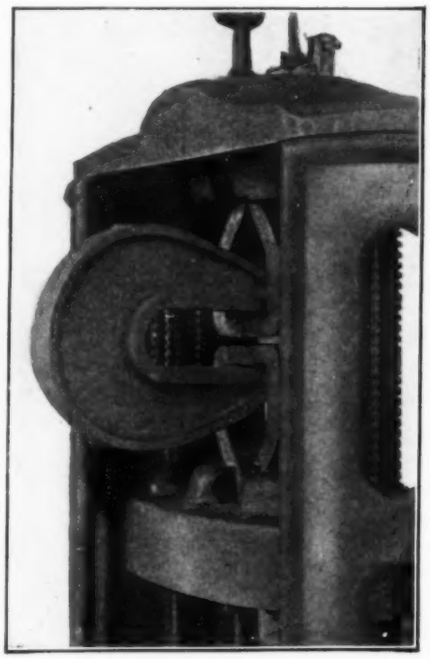


FIG. 7. METHOD OF TESTING THE SPECIMENS

This method gives about 1500 pounds for the stress due to the load and about 18,000 pounds for the initial stress due to cooling, which is considered absurd. Hence this method does not offer a satisfactory explanation.

(*b*) In Fig. 4 the load W produces a bending moment at the section $A\,D$ equal to $W\,N$. This moment is resisted by the moment $\frac{S\,I}{c}$ where S is the stress at A, I the moment of inertia of the section between A and D, and c the distance between the center of gravity of this section and the point A. The fracture of casting No. 5 suggested this method as a possible cause of failure. At a load of 8500 pounds a fracture occurred behind the inner flange and the load dropped almost to zero. Upon further application of the load the crack gradually approached the outer flange, then the inner flange fractured and finally the outer flange separated. According to this method of analysis the average unit stress at A in the five castings was about 22,700 pounds when the fracture occurred, which is excessive for tensile strength. This does not consider a possible shifting of the neutral axis, however, which would tend to decrease the value of the result. There are also reasons for using a larger value for N. By changing the values of N and c, it is possible to change the value for the stress, hence this method could not be relied upon without making many tests on different sized specimens with different thicknesses of flange.

(*c*) Considering the flanges as separate members having pin connections at points A, E, F and G, in Fig. 5, the load W would tend to increase the distance between the points A and G. If A and G be connected by means of a link, the stress in it may be found as follows: Draw the lines $E\,G$, $F\,G$, $E\,A$ and $F\,A$ and let them represent links with pin connections. Then produce $G\,A$ until it cuts the line of application of the load at K. The triangle $A\,K\,E$ may be taken as the force diagram where $K\,E = \frac{W}{2}$ and $K\,A$ is equal to half the stress in the link $A\,G$. In the specimen, this stress is taken by the web, the area of which is the outside diameter $p\,p$, of the inner flange multiplied by the thickness of the web. According to this method the unit stress is about 18,000 pounds, which seems to express the stress relation very satisfactorily for this particular case, but it is not probable that such results would be derived from castings having a thicker flange.

Casting No. 7, Fig. 8, was first subjected to a compressive load acting on the horizontal side of the notches cut in the outer flange. This caused failure near the line of application of the load, as shown in the halftone. It was then subjected to a tensile load acting at a distance of 5 3/16 inches from the inside of the spine.

Casting No. 9 had 3/16 inch of the outer flange removed on both sides. This, however, did not seem to affect its strength.

Casting No. 12 had the outer flange removed on both sides and the inner flange reduced to 1 inch wide at a distance of

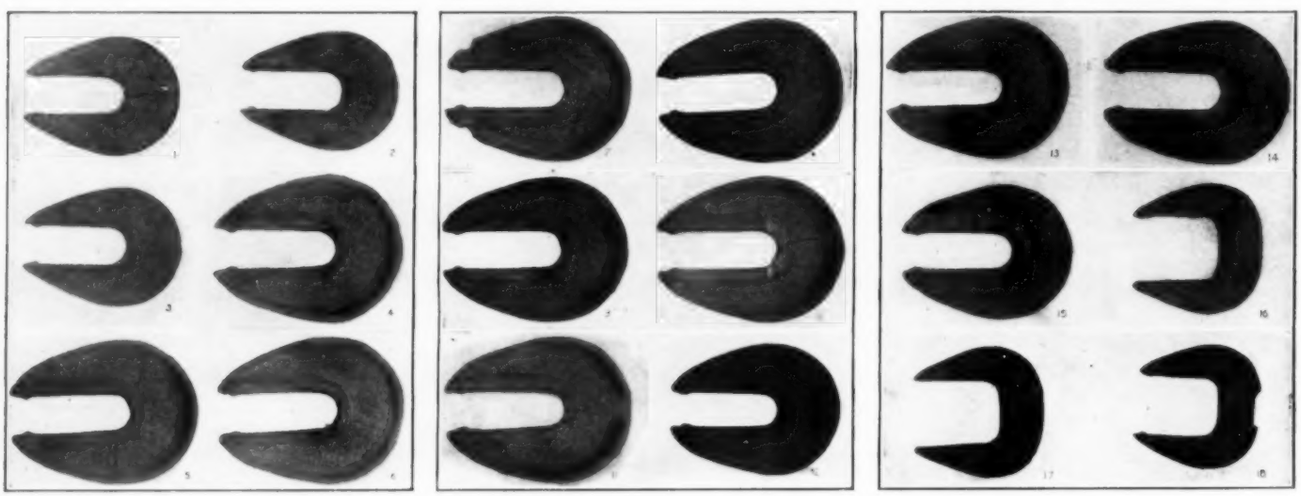


FIG. 8. TEST SPECIMENS AFTER FAILURE

Tension Specimens.				Transverse Specimens, Length 12 In.				Curved Specimens.			
									Unit Stress at *ab*.		
Test No.	Breaking Load.	Area, Sq.In.	Stress, Pounds per Sq.In.	Breaking Load.	Area (Breadth × Depth).	$S = \frac{MC}{I}$.	$K = Si\frac{bd^3}{M}$.	Breaking Load.	Beam Formula.	Résal's Formula.	Pearson-Andrews Formula.
1	15,000	0.785	19,100	2,380	0.75 × 1.25	36,560	3.14	11,200	16,240	27,025	33,013
2	14,630	0.785	18,620	2,880	0.75 × 1.25	44,200	2.52	11,125	16,120	26,844	32,796
3	13,460	0.709	19,000	1,680	1.25 × 0.75	46,080	2.65	11,390	16,540	27,484	33,577
4	17,000	0.785	21,630	2,280	1 × 1.05	37,200	3.48	9,300	11,330	19,583	38,223
5	17,000	0.785	21,630	2,000	1 × 0.95	40,000	3.25	8,500	10,500	17,909	34,935
6	15,500	0.833	18,600	2,160	1 × 1	39,000	2.86	12,600	22,520	25,870	29,460
7	16,300	0.866	18,750	2,380	1 × 1	43,000	2.62	12,000	9,790	12,584	27,048
8	15,070	0.724	21,700	2,310	1 × 0.95	46,250	2.82	15,300	12,600	18,420	—
9	18,000	0.785	22,920	2,200	1 × 1	39,600	3.97	8,300	10,130	19,164	36,530
10	16,000	0.785	20,370	2,300	0.95 × 1	43,700	2.70	8,400	10,520	—	—
11	17,800	0.754	23,600	2,060	1.02 × 1	36,400	3.94	5,200	18,420	21,040	—
12	18,000	0.785	23,000	2,070	1 × 0.98	38,000	3.56	8,400	10,235	17,500	34,524
13	18,000	0.754	24,400	2,440	1 × 0.98	45,000	3.20	5,800	—	—	—
14	16,300	0.739	21,800	2,300	1.02 × 1	40,600	3.22	12,700	23,920	26,435	28,700
15	16,100	0.754	21,400	2,240	1 × 1	40,400	3.18	12,500	23,400	26,025	28,250
16	16,730	0.785	21,270	2,460	0.75 × 1.25	37,800	3.41	11,255	16,320	27,160	33,300
17	17,340	0.785	22,080	2,741	0.75 × 1.25	42,200	3.17	11,980	17,270	28,987	35,400
18	17,900	0.785	22,800	2,680	0.75 × 1.25	41,300	3.35	10,600	21,476	—	—

RESULTS OF TESTS.

6½ inches from the load line; but this did not seem to affect its strength. The unit stress at the milled section according to the formula $S = \frac{Mc}{I}$ was 34,805 pounds.

Casting No. 10 had the inner flange reduced to 2½ inches wide and failed horizontally as shown. Failure in this manner was probably due to a flaw in the inner flange that extended into the web.

Casting No. 11 had about 2 inches of the outer flange removed on both sides and the width of the inner flange reduced to 2 inches.

Casting No. 13 had both flanges removed at a distance of 6.8 inches from the line of application of the load. The stress at this point according to the formula $S = \frac{Mc}{I}$ is 31,160 pounds per square inch.

Casting No. 6 is the same as shown in Fig. 2 with the exception of having the thickness of the web increased to 0.93 inch. The fracture occurred at an angle of about 30 degrees with the horizontal. There seemed to be a tendency for the fracture to follow the inner flange.

Casting No. 8 was subjected to a compressive load and failed at a section 7 inches from the line of application of the load, the stress being 35,370 pounds according to the formula for beams.

Casting No. 14 had the thickness of the web increased to 0.93 inch and provided with large triangular fillets behind the inner flange. By comparing the results of this test with those from No. 6, it seems that enlarging the fillet does not appreciably effect the strength of the casting.

Casting No. 15 is the same as No. 14 with the outer flange removed. The results seem to show that the outer flange on No. 14 adds but little to its strength.

Casting No. 16 failed in a curved portion. The angle between the plane of fracture and line of application of the load is about 79 degrees. The stress in this section by formula

$$S = \frac{Mc}{I} + \frac{W \sin. \theta}{A}$$

was 16,300 pounds.

Casting No. 17 failed in a curved portion, the angle being about 48 degrees. The stress in the fractured section by the same formula was 17,300 pounds.

Casting No. 18 is the same as No. 16 and No. 17 with the depth of spline reduced to 3.4 inches. The stress at fracture was 21,476 pounds.

Conclusions

Although these experiments are not sufficiently exhaustive to render any rigid conclusions, they seem to indicate that the following statements are approximately true:

(*a*) There is no rational method for predicting the strength of curved cast-iron beams suitable for punch and shear frames.

(*b*) Of the three formulas suggested for the design of punch frames, the well known beam formula,

$$S = \frac{Mc}{I} + \frac{W}{A}$$

is the most accurate statement of the law of stress relations existing in such specimens.

(*c*) The stress behind the inner flange at the curved portion is an important consideration that should be recognized by the designer.

(*d*) There seems to be no definite relation existing between the strength of a curved cast-iron beam and the transverse strength of a test bar cast with it.

(*e*) The Résal and Pearson-Andrews formulas are unwieldy and awkward in their application and offer many chances for error.

The Portable Electrical Drill

The little portable electrical drill which may be operated by current from any lamp socket, is one of the handiest tools that ever came down the pike—likewise it bids fair to be one of the most abused. Tell the boys a thing or two about these drills and then they won't abuse the tool so much. But if the cub persists in the abuse after being duly posted, then fire him, for he has not the making of a valuable workman in his get-up.

To begin with, don't crowd the tool until the drill stops revolving; that may burn out the armature winding. It will surely injure it ultimately even if it does not burn it out the first or second time. And if you should stop the motor by too hard feeding, then let up instantly and start the drill with as little delay as possible. It is better to give the switch handle a turn, cutting off the current, the instant the drill stops. This can be done quicker than the drill can be raised or twisted loose from whatever stopped it. Tell the boys that any electrical motor is liable to burn out if full current be sent through the armature winding when the motor is at rest. On large motors which necessarily must start slow, a resistance box must be used to cut down the current until the motor armature gets up to speed.

When a motor armature is running at normal speed, it acts as a generator on its own hook and works up an E. M. F. which is just large enough to act as back pressure against the driving current and opposes all but just enough to operate the motor to its full capacity. When the drill armature is stopped with current on, there is nothing to hold back the heavy current which will be forced through the armature winding by the line voltage, and the armature winding immediately begins to heat. To be sure, drill armatures are designed to stand a good deal of overcharging and all kinds of abuse, but the bad effects of overcharging are cumulative, and some time the little armature will get tired and discouraged with the struggle and let go.

Only today, one of the boys in the shop put a drill out of commission in this very manner. It took the electrician nearly three hours to overhaul the drill again. Therefore, don't crowd a portable electric drill until it stops.

Is There Any Best Machine Tool?

By W. Osborne

"I am so far from knowing which is the BEST make of lathe on the market today, that when I have to select one I depend quite a bit on the judgment of my men, the more so when their work records confirm their statements as to the merits of the various tools."

It was with much satisfaction that I read the article "Buying Some Machine Tools." Entropy tells of some of his own experiences in buying, and also lets out the fact that most of us do not know much about how to do it. I have realized for quite a time that I could not pick out the best machine of kind wanted, but thinking that I might be different from others in this respect I have tried to conceal the fact. Seeing it is the common condition of men who have been raised in the shop, such efforts are in vain. They are worse than useless for they are a waste of energy, and that is a mechanical crime.

Misery is noted for loving company, and while Entropy at least by inference almost acknowledges that he knows all about the selection of the best tools, yet it is evident that he does not know all about how to secure them in a reasonable length of time. Perhaps that statement should be modified to some extent. Being a man of experience and ability, he selected the best machine. Up to this point everything was all right.

It was when he tried to buy the machine that his troubles began.

Knowing as he did that the profits on "chip makers" are very large and perhaps wishing to keep some of the money in circulation near home he gave the order to a local dealer at a price that the dealer had quoted.

In the meantime one of two things happened. This statement is deduced from a careful reading of the technical press. The makers of "chip makers" had discovered that business was subnormal and that made the overhead costs high. To rectify matters it was necessary to raise prices; or they had discovered that they were behind on their deliveries and getting more so. The logical way was to raise prices high enough to chase some of the orders away. A little raise of about 28½ per cent. seemed about right for the purpose. Evidently it only partly worked at least in the case of Entropy. He was soon back, which was natural, for he knew that the machine selected was the best one of its kind made. So many other people were of the same mind and had gotten in ahead or were giving larger tips that he did not get served in reasonable time. Finally he got to the end of his endurance and went and bought a machine for 10 per cent. less than regular price, yes not only bought it but had it delivered and at work inside of two days. Here, it is to be regretted, he digresses. What sort of work has that machine been doing? When he sets the fashion and enters suit against the firm that did not fill his order how much damage can he show that is caused by the use of a second choice, or "Hobson's choice" machine? How does he compound with his mechanical conscience when he walks through the shop and sees that machine at work?

He speaks of some shop men who would not know enough to pick out the *best* 48-inch planer. I am not sure that I could clear my own reputation in such a case unless I knew something more than I now do of his ideas on that subject. Even if I should acquire a reputation with him by choosing the one that he knows is the best one I would not be able to let anyone else see it for a lot of makers, dealers and users of other makes would be unkind enough to say that the reputation was bogus.

Perhaps Entropy will kindly give a formula that a man of ordinary intelligence can work that will enable the best machine to be picked out.

Even if the formula will only give a close approximation it will be a step in the right direction.

My Experience in Buying a Lathe

Some time ago a shop wanted a lathe and I was entrusted with the job of selecting it. The American Machinist lists 52 makers of lathes.

Not one of these makers will step forward and say that the others make a better lathe than he does. Every one of them that has been in business for any length of time can point to users who are getting the best of satisfaction from their machines, and perhaps also a dissatisfied user can be found for each one of them by some "knocker."

Having nothing to go by but my own experience and observations and the testimony of others, I was somewhat at a loss to know which lathe to select.

In my search for information and catalogs and prices I got several machine-tool salesmen interested and that opened up large storehouses of information. If there had been only one of them or if they had all been working for the same firm, there would not have been any trouble in selecting the best lathe, but unfortunately for my chance to feel good over the excellence of my mechanical judgment, they worked for different firms.

One man was confident that I recognized the importance of a strong pulling lathe. His pulled 22,500 pounds at full swing. From the standpoint of pull it was the best. Another one knew that rigidity is the thing. His machine weighed 11 per cent. more than that of his nearest competitor. But a third one knew that I knew that convenience of operation was where the money was made. No other machine had the stops and feeds that his had.

A fourth man was sure that I did not care to pay for talking points. A man of my experience wanted a lathe for service and that being the case, this was the one without any frills.

I began to feel that it might be a good thing for me to do a little bit of analyzing before I bought a lathe. I soon made up my mind as to the number and kinds of frills that I wanted, and could judge somewhat as to convenience of operation. The specifications of most of them gave the weights and that left the pulling power. Starting with a 42-inch lathe that had a pulling power of 22,500 pounds at full swing, I found that if friction losses between the belt and the tool were disregarded there was a belt pull of 60 pounds to each inch of width. With that as a starting point I began figuring on the pulling power of other makes of lathes.

What I Found out About 42-inch Lathes

The lathe used as a starting point was called an "all geared" lathe by the salesman. It had a single pulley on the headstock. One of the other catalogs in my possession showed another 42-inch lathe that had a single pulley instead of a cone. Figuring it the same way showed a pull that would give 20,000 pounds at the point of the tool at full swing.

Getting interested about this the other catalogs were looked over for 42-inch lathes. The triple-geared ones were selected and here are the pulls: 17,400 pounds, 11,700 pounds, 11,300 pounds, 10,500 pounds, 7800 pounds, 7100 pounds, 6200 pounds, 5800 pounds, 5350 pounds. I began to feel for the man who deluded himself into making some of them.

Seeing that some makers also made, or at least cataloged 42-inch lathes with five-stepped cone and ordinary back gear, I figured on a couple of them. One gave a pull of 1440 pounds and the other one a pull of 1220 pounds. I spread some of my sorrow over the makers of these lathes, and continued my investigation down to the regular 36-inch lathes, and got these figures: 1680 pounds, 1320 pounds, 1290 pounds, 1220 pounds. I noticed that the 36-inch lathe that pulled 1220 pounds, the 42-inch lathe that pulled 1220 pounds and the 42-inch lathe that

pulled 20,000 pounds were made by the same firm. Lest some hypercritical person should read this, I will state that the pulling that these lathes did was done in the realm of "pure mechanics." The work was certified to by my "guessing stick." That is the name some people apply to the humble slave who does most of my figuring for me; other more considerate or better informed people call such "personal attendants" "slide rules."

What I Found out about Lathes in the Shop

About this time I began to wonder what sort of pulling the lathes in the shop were doing. The smaller ones had single belts and for comparison a value of 42 pounds to the inch of width was used. The pulls ranged from 1200 pounds for the 32-inch down to 475 pounds for a 16-inch. One double back-geared 20-inch lathe that the boys were proud of showed a pull of 1070 pounds, and a 20-inch single back-geared lathe by the same firm gave a pull of 830 pounds. Catalog lathes and lathes in use were compared with very little difference for the same types of lathes. One maker showed 1090 pounds for his 20-inch lathe and 520 pounds for his 16-inch one. Another maker showed 910 pounds for his 20-inch lathe and 850 pounds for his 16-inch one. A 20-inch lathe that had done years of hard heavy cutting had a pull of 910 pounds, which was less than another lathe had that had a very poor reputation as a puller.

Judgment of the Men in the Shop

After having had personal experience in running a number of different makes of lathes; after comparing sizes, weights and pulls; after being thoroughly informed by salesman, letter and catalog; still I must confess that I am so far from knowing which is the *best* make of lathe on the market today, that when I have to select one I depend quite a bit on the judgment of my men, the more so when their work records confirm their statements as to the merits of the various tools.

I certainly envy Entropy his ability to dig up prices. He gets a range of three to one when he wants a lathe. The best that I could do was to find that some builders made the sized lathe that I was interested in by stretching up the next smaller size, while others did it by squeezing down the next larger size. The buyer, naturally, was expected to pay for the stretching and the squeezing. That somehow made a variation in prices but not anything like he mentions. With an ability to know the best lathe and with an ability to buy it below cost a man should be able to do things to the business of his competitors if he has any.

Some of My Negative Knowledge

Much of my knowledge on the machine-tool problem might be called negative knowledge. As one small boy expressed it, I "know lots of things that hain't." I know that because a machine is widely advertised and sold it is not safe to take as proved that it is at the head of the class.

I know that because the highest price is asked for a machine it is not, therefore, safe to assume that the workmanship and material are above reproach. I know that the fact of a design having been "improved" or the entire machine redesigned does not always increase its desirability as a work producer. Sometimes, when I hear a man praising a new machine that he has bought, I do not know whether he is praising is because he finds it the best for his work, or because he wants to make himself think that his judgment was good in buying it, regardless.

One thing I am sure of. If I were to name, out loud, any lathe in the land today as being the best, doing it loud enough so that all of the firms building lathes could hear me, the proofs that would be forthcoming to show that I lacked ability of any kind in things mechanical would be overwhelming.

Developments at Purdue University

By C. H. Benjamin*

New buildings for drawing and shop work: a Prony brake for the Vauclain locomotive and a sensitive weighing machine for testing wear of car wheels.

During the past year, new buildings for mechanical drawing and shop work have been under construction at Purdue University. This group consists of a main building, wood shop and machine shop, foundry and forge shops, tool rooms and lecture rooms. The material is brick, steel and wood, the factory type of construction being employed.

One interesting feature of each of the shops is the introduction at the side of each room of a wide alcove or open room containing seats arranged in amphitheater style and facing the opening. The instructor locates his machine, bench or anvil immediately in front of the opening and proceeds to demonstrate the lesson for the day in full view of the seated students. The design of the building is largely the work of Prof. M. J. Golden, who is at the head of the Department of Practical Mechanics.

The old shops will be converted into additional laboratories for advanced work. The new laboratory will contain rooms for the mixing and testing of cement and concrete. The gas-engine laboratory will furnish accommodations for a 50-horsepower gas producer and engine, seven gas engines of various makes, together with quite an assortment of automobile and motor-boat engines. A concrete and steel testing floor will furnish accommodations for testing small units.

The hydraulic laboratory will have a cement floor with conduits, tanks and pits and a raised gallery for the smaller apparatus. An addition to the steam-engine laboratory furnishes accommodation for small engines and the testing equipment for gages, indicators, etc., together with space for apparatus and equipment used in connection with the course in heating and ventilating. These additions will make the Purdue laboratories as ex-

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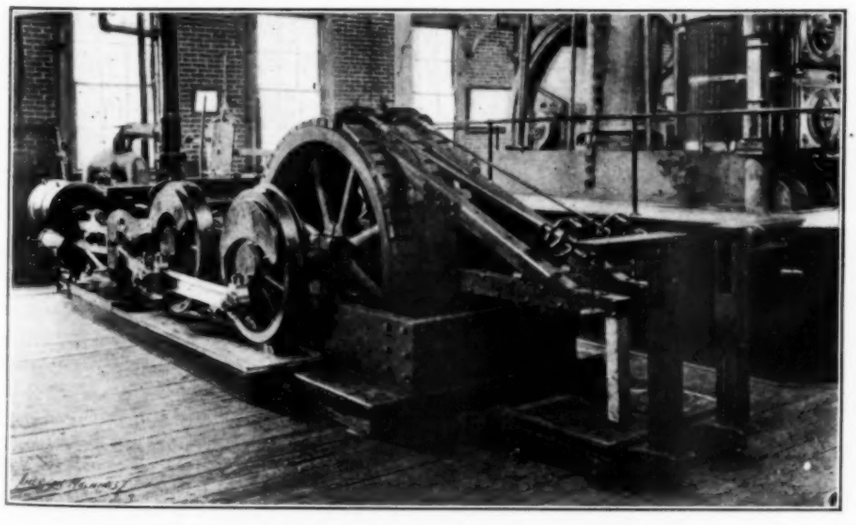

Fig. 1. Baldwin Compound Locomotive with Brake

tensive and as well equipped as any in the country.

Using the Baldwin Locomotive

Some of the features which have been added to the laboratory the past year are of especial interest. The Baldwin or Vauclain compound shown in Fig. 1 was presented to the university by the Baldwin Locomotive Company in 1894 but has not been much used on account of the difficulty in absorbing the power. It has recently been equipped with another pair of drivers, carrying on the axle two large Prony brakes capable when used together of absorbing from 600 to 800 horsepower. These wheels are 6 feet in diameter and have 14-inch faces. Thus equipped, the engine, although stationary, will be available for numerous experiments on steam expansion and regulation.

A Very Accurate Weighing Machine

An exceedingly accurate and very interesting weighing machine has been used this year for weighing car wheels, to determine the loss caused by the continuous application of brakes. The scale was built by William Sellers & Co., of Philadelphia, and consists of a beam like that of a chemist's balance supported on ribbon knife edges at the center and carrying the car wheel to be weighed at one end while the equivalent weights are applied at the other. So sensitive is this balance that when both wheels and weights are in position, although the total weight on the balance is about 1500 pounds, an ordinary visiting card laid on either end will deflect the beam. It has been found possible to weigh within about 1/5000 of a pound or about one part in four million. This apparatus belongs to the Master Car Builders' Association but is available for laboratory use.

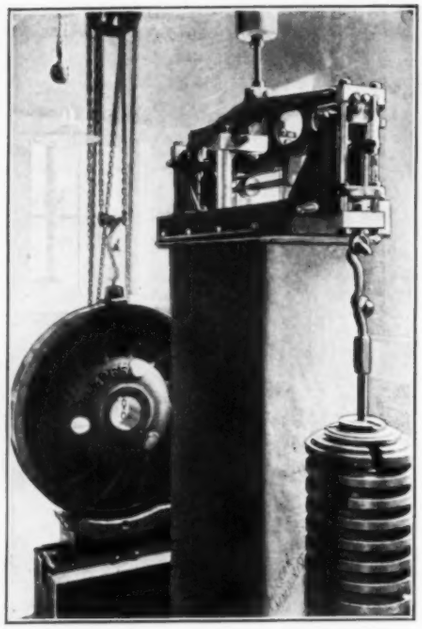

Fig. 2. Scale for Weighing Car Wheels

Vanadium-nickel steel eyebars designed for use in bridge construction were recently tested by the American Bridge Company with apparently very favorable results. The bars measured 14 inches by 2 inches by 35 feet and showed an elastic limit of 80,840 pounds, and a tensile strength of 99,890 pounds per square inch, with an elongation of 32.5 per cent. in 12 inches, and a reduction in area at fracture of 52.3 per cent. Part of the bar was bent cold under a 14,000-ton press, and flattened upon itself without sign of fracture.

Experiment with Cambric Pinions

By John Riddell*

After trying pinions made of the more common materials on a large punch and shear, without filling the necessary requirements, a pinion made of muslin was substituted with gratifying results.

Eighteen months' service shows no appreciable wear.

A brief description and history of this invention may be of interest.

A large punch and shear, driven by a motor through a train of gears and installed in a blacksmith shop, where the work is very heavy and rough, had been giving a great deal of trouble, both from noisy gears and from stripping of the gear teeth.

As originally fitted up, the train of driving gears consisted of a brass pinion on the motor shaft which drove through a cast-iron cut gear on a countershaft, and this, in turn, through another pinion connecting with the main gear of the machine. The countershaft carried a heavy flywheel, which, when running, caused a backlash that several times stripped the teeth from the cast-iron gear. The brass gear also soon lost its shape and gave trouble. After this experience a street-railway gear and pinion were used, but they made an intolerable noise and had to be discontinued. It was at this stage that the inventor, looking for a substitute which would stand up, and having in mind rawhide and fiber, bethought him of having a muslin pinion made. This pinion was accordingly made, and was put on the punch over a year and a half ago; up to the present writing, it has not given a particle of trouble, neither does it show any appreciable signs of wear.

Since that experience, a great many other troublesome machines have been similarly equipped, until at present there are 700 of these cambric pinions in active service, and as yet not one has failed.

In making these pinions, the following process is followed. The muslin is cut out in disks which are assembled and pressed between two steel washers, the whole then being securely fastened with rivets or tap bolts, following the same method as that of making rawhide pinions. The blank is next turned to the proper diameter and the teeth cut in a gear cutter. The gear is then soaked in a good quality of machine oil.

These pinions can be made in various forms, of any reasonable size, and either with or without metallic centers. It is absolutely necessary, however, for the

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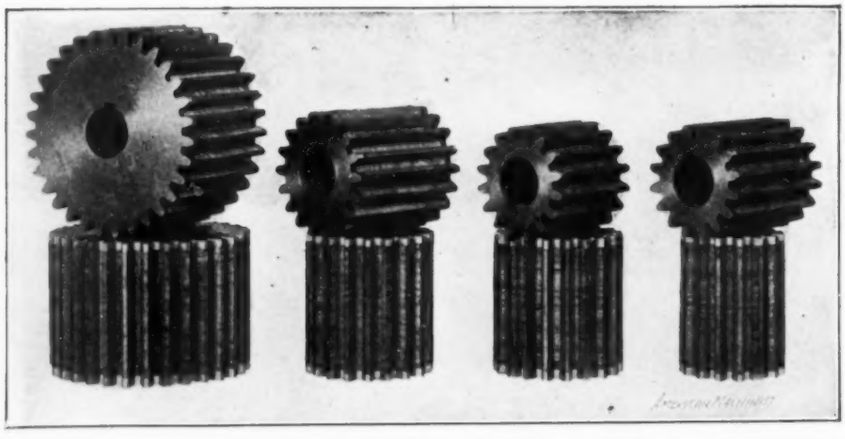
Note—Reprinted from the *General Electric Review*.



Cloth Pinions for Individual Drive of 152-inch Paper Making Machine

shrouding to extend to the full diameter of the gear.

With these pinions, the use of lubricants is unnecessary, as the oil which was absorbed by the muslin in the oil bath will keep the teeth of the pinion lubricated for an indefinite length of time. In the actual running of these gears they seem to take a metallic coating on the teeth, which tends to protect them from excessive wear from the teeth of the other gear.

In addition to these features, there is also a certain amount of flexibility which is beneficial, as in all commercial gears there is apt to be some slight inaccuracy in the spacing from tooth to tooth. When such gears are run with other metallic pinions there may be, and frequently is, an excessive strain brought on one tooth, which tends either to bend or break it. With the cloth pinion, however, the flexibility afforded by the material tends to distribute the strain over at least two or more teeth, depending on the size and number of teeth in contact; these will stand any reasonable amount of this bending, there being no fibers to crystalize as in the case of the metallic gears.

Some engineers, when the matter was first brought to their attention, were inclined to be a little skeptical, but the pinions have given and are giving a practical demonstration of their merits by running every day in the hardest kind of service. An inspection of some of these cases would, I think, satisfy anyone as to their worth.

Multiple Spindle Drilling Attachment

By D. E. Rose

Details of an attachment, applicable to most drilling machines, by the use of which drilling holes with short center distances is greatly facilitated.

Multiple drilling on short center distances is a problem which looms up quite frequently these days. It seems that no matter how short a center distance a machine will accommodate, there is generally some job that could be more profitably done, could the machine drill on still shorter centers. The accompanying sketch illustrates the construction of an attachment applicable to almost any kind of a drilling machine, by which holes with short center distances can be drilled. This device can be attached to or detached from the machine, as the occasion may require, thereby not limiting the machine to one particular piece of work.

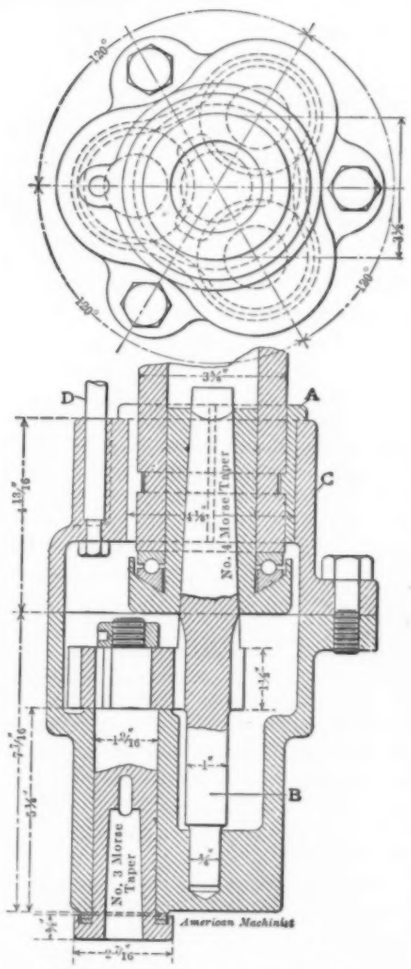
The problem to which it owes its conception and subsequent design, was to drill three 1½-inch holes, arranged on a circle, 3½ inches center distance and 120 degrees apart, without materially increasing the upward thrust on the spindle sleeve.

In order to attach this device to any machine already built, the spindle and spindle sleeve must be taken out, the flanged end of the former recessed as shown, to receive the ball bearing. If there is no flange on the spindle, a collar may be shrunk on and afterward finished as stated.

In the spindle sleeve, a small groove must be turned to receive the offset in the steel bushing *A*. This bushing is bored to fit the sleeve and afterward split in order to get it in place.

The driving of the drills is accomplished by spiral gears, the ratio of which must be determined beforehand, this being governed by the spindle speed of the machine and the speed the drills will be required to run. Many combinations may present themselves in making this calculation, and it remains with the designer to choose the best one, according to his judgment and the conditions.

To transmit the power from the machine spindle to the drills, the shaft *B*, on which are cut the pinion teeth, should be turned to fit the taper in the machine spindle. It should also have a tang on the end. Gearing into the pinion are the three gears mounted on the smaller drill spindles, which contain the smaller tapered holes to receive small drills. These smaller spindles are flanged on the ends and recessed to receive two bronze washers to allow for the taking up of wear. Mounted on the flanged end of the large spindle is a Hess-Bright thrust ball bearing which takes care of the increased thrust.



MULTIPLE-SPINDLE DRILLING ATTACHMENT

All the parts are inclosed in a dirt-proof casing, which is made in two parts, the upper part *C* being bored out so as to make a push fit on the bushing *A*. Provision may be made for the feed trip rod, which is shown at *D*.

The device is held in place by the friction of the tapered end of the shaft *B*. This will be sufficient when the construction is not too heavy, but should the attachment be too heavy and the taper fail to hold it, a set screw or two, through the upper part of the casing *C* and tightened against the bushing *A*, will hold it in place. A brass plug should be placed between the end of the set screw and the bushing, to prevent marring the surface of the latter.

All that is necessary to place the attachment in the machine is to push it into place and perhaps give it a few taps with a soft hammer, following practically the same procedure as in setting a drill.

In detaching it, a drift does the trick and the machine remains the same as before, with the exception of the ball bearing, which must remain, but this is an advantage, increasing, as it does, the thrust on the sleeve.

The use of the oxy-acetylene process for welding and cutting metals in railway shops is extending rapidly and promises to become one of the essentials of first-class shop equipment, according to the *Railway Age Gazette*. It has made greater progress in other countries because the business has been handled with more intelligence and systematic methods have been used to instruct the men in safe and effective methods of handling it. It is pointed out that there are many uses for the process in various kinds of work about railway shops to which it has not yet been applied.

Reduction in Cost of Navy Yard Work

By Holden A. Evans*

How scientific management was applied to navy yard work.

The various difficulties encountered, how they were met, and the methods that resulted in substantial reductions in cost.

*Naval constructor, United States Navy.

I hesitate to give examples of my experience in navy yards. I fully realize that our navy yards have a poor reputation among business men and managers. There are some managers and engineers whose opinions are of value who know the difficulties in navy yards—the almost insurmountable difficulties—and who also know that fairly good results have been accomplished in spite of these difficulties. The majority of managers, however, will feel that conditions have been so bad in navy yards that amateurs can make marvelous reductions in cost if the effort were only made. To these I can only say, visit the nearest navy yard and spend a week. Study conditions. Such a visit will, I am sure, convince the most skeptical that it is not easy to produce good results in a navy yard.

Before enumerating a few examples of my experience in navy yards in reducing costs, I wish to state that I have experienced most strongly the feelings of the manager who knows that costs can be enormously reduced and who tries himself to take up the various departments and shops, hunt for the leaks, stop them, provide improved methods, and at the same time exercise proper supervision of the department as a whole. Everywhere I could see opportunities for large reductions in cost if I could only give my undivided attention to these points. This, however, is impossible on account of many other duties. I could, therefore, only touch the high points and rest satisfied that the department under my management was producing as good results as any other navy-yard department, and that it excelled a number. This, however, is poor satisfaction to one who firmly believes in the principles of scientific management.

The Mare Island Navy Yard, where I have been on duty for the past six years, labors under the disadvantage of a limited supply of skilled mechanics. Wages are very high, first-class mechanics received from 52 to 63 cents an hour, while helpers and laborers received 30 to 32 cents an hour. On account of labor conditions and politics the output was low. It would seem that the very high cost of labor would have brought forth the very best efforts to obtain scientific management. Such, however, was not the case. The very fact that labor was so high brought about the assumption that Mare Island could not compete with other navy yards in costs, and when high costs were reported, conditions were not investigated, as it was assumed that the high costs were due to the high cost of labor. It also required some courage to undertake reforms at Mare Island. The one attempting reforms was assailed and was the target for abuse from the local papers. So strong are these influences that in the past they have brought pressure to bear on prominent politicians who have actually obtained the removal of competent officers who have attempted reforms. Mare Island could, therefore, not be called a promising field in which one would experiment with scientific management. In spite of these difficulties some advance has been made. Enough at least has been accomplished to prove that scientific management, if applied to its fullest extent will produce enormous reductions in cost.

The boat shop was one of the first shops investigated. This is a fine shop and generally well equipped with tools and appliances. Yet when investigation was made one of the first discoveries was that there was not a power cutoff saw in the shop and all cutting off was done with hand saws by boat builders at 57 cents an hour. Marked reductions in cost were made by installing comparatively inexpensive tools and appliances.

Much Hand Work; Little Machine Work

No expert machine hand or millman was employed, and only the most simple operations were performed with machine tools. Each boat builder built complete his own boat, each doing his own mill work and deciding for himself which should be hand work and which should be mill work. It is needless to say that the great majority of the work was hand work. After considerable difficulty I located an expert machine hand. He, with an intelligent helper, formed the mill gang. These are required to get out all of the machine work and the boatbuilders are only allowed to use machine tools for the simplest operations as, for example, using a cutoff saw and simple band-saw work.

The millman was encouraged to develop the machine work as much as possible. He had a great deal of ingenuity and in a short time the results were surprising, as he was doing work by machine that had previously been considered impossible. All of the planking is gotten out on a double-headed shaper. The heads of this shaper have collars below the knives. A templet presses against the collar acting as a guide, the knives cutting the material to the shape of the templet. The plank is run down one side, one head cutting and brought back on the other, and is finished except for the slight bevel necessary. The thwarts, gangboards, footlings, beading, and all material of this kind are gotten out by the millman.

The millman has developed wonderfully; he takes great pride in his work and is all the time looking for some new work he can do by machine instead of by hand. The helper has also become an expert millman. He is not employed as a laborer to do the carrying of work of this kind, but is, in reality, an assistant millman. He can now do any class of machine work and, in the absence of the millman, takes entire charge of this part of the work.

Work is Classified

The preparatory work, before the erection of the boat begins, is carefully classified according to the nature of the work. The capabilities of the various men are studied and the work is assigned to the man best qualified for that class of work. In some cases it was necessary to develop men. The work to be accomplished by each man or gang is clearly defined and written instruction cards are issued. The various operations are carefully planned so that the various parts come together at the right time for erection.

The Procedure Followed

All of the material is assembled, the foundations are prepared, the frames are bent, the planking is gotten out, and then all of this material is turned over to the boatbuilder and his helper for erection and completion. An account is opened up against the boat and the boatbuilder is held responsible for the cost. It is assumed that all boats will have the proper inspection and be of equal quality, and the cost then determines the efficiency of the workman. When introducing this method, it is very desirable to build a number of boats of the same class, so as to obtain competition between the workmen and determine their relative efficiency.

When I started this system there were fortunately a number of boats of the same class to build and we were able to immediately compare the efficiency of the workmen and weed out the poor men. As an example, we would take six 30-foot cutters and distribute them to various men, an account being opened up against each man. Very astounding results were

obtained. For example there were two boatbuilders working side by side on 30-foot cutters. I spent a good deal of my time in this shop and one of these men I had put down as a loafer, and he would have been the first man discharged if there had been a lay-off. The man working alongside of him I put down as the hardest worked man in the shop. When the costs came in, the "hardest worked" man's boat had cost $200 more than the boat of the "loafer." I called the expensive man to the office and asked him for an explanation. He stated that he had worked as hard, or harder, than any man in the shop, and that I must know this by personal observation and that he could not tell why his boat cost so much more than the other man's. I asked him if he had any complaint to make of the material he had received or of his helper, and he answered that he had none.

I put out two more boats to the same men and obtained practically the same results. In other words, the man that was apparently taking it easy used his brains as well as his hands and made every blow tell, while the "hard-working" man had very little brains to use. Both of these men were rated as first-class boatbuilders and were getting the same pay, although one was of much more value than the other. There was nothing to do but discharge the man whose cost was excessive and this was done.

The cost to which I am now referring is not the total cost of the boat, but only that cost for which the man himself and his helper are directly responsible. Before introducing this system I had informed all of the boatbuilders of the methods that I proposed to pursue, and further informed them that I would establish an efficiency list based on the cost of boats, and that when a reduction of the force was necessary, which everyone realized would come in a few months, the men whose costs ran high would be the ones discharged. The results were almost equal to piece work and if any man was delayed or was not furnished with the proper equipment, I heard from it at once.

Development of Helpers

It is believed that helpers and laborers have, in the past few years, been used at Mare Island for higher class of work than is generally given these men to do in other yards. The boat shop is no exception to this rule. The methods followed and described in the preceding paragraph, that is, holding the boatbuilder responsible for the cost of his work, has done much to develop the use of helpers in the boat shop. Under the system followed, the boatbuilder is personally interested in keeping the costs of the boats as low as possible. It is, therefore, to his interest to utilize the services of his helper to the best advantage.

In many shops when any attempt is made to utilize the helpers for higher class of work than is usually done by helpers, this effort meets with the active opposition of the mechanics in the shop, while in the boat shop exactly the reverse was the case. The boat builders encouraged and taught the helpers and shoved them ahead and gave them all the work that they were capable of doing. With this encouragement from the mechanics, it is needless to say that the helpers advanced very rapidly, and we now have helpers that I have no doubt would be rated as boatbuilders in many yards. These helpers do practically all of the boring off, trimming oars, fitting boat hooks, planing the bottom of boats, riveting, etc. In fact all of this class of work is done by the helpers.

Every Operation Studied

The above indicates in a general way the methods pursued, but lack of space forbids a detail description of every change in methods and a description of the detail methods followed. It can be stated, however, that every operation was studied in an effort to determine the best way of doing the work and the best machines and the best men or class of men for accomplishing the work.

Establish a Low Price for Each Class of Boats and Keep the Shop Up to the Standard

After once establishing a low price for each class of boats it is not difficult to keep the shop up to the standard. I have our standard low prices before me and when a cost is reported exceeding these standard costs, an investigation is immediately made to determine the fault.

Results Obtained by Changes in Methods

As the boats built are standard a direct comparison can be obtained of costs, and the amount saved on new boats can be determined. By making this comparison it was determined that in two years' time over $25,000 was saved on new boats by the changes in methods. A large amount of repair work is also done in this shop and the improved methods have greatly decreased the cost of this work, but the actual amount saved cannot be determined. In many cases the costs of boats were cut in half and in some cases the reduction was even more.

Costs Can Be Further Reduced

While great reductions have already been made in costs, it is realized that still further material reductions can be made. This, however, can only be done by giving to the shop for some time the attention of an expert who will further study the subject. This cannot be done; there are many shops in the department which require attention and these must be improved before the boat shop can again receive attention.

Wood Calking

Practically all of the wood calkers on the Pacific coast belong to an association. This association is very powerful and very few care to antagonize it. The number of apprentices is limited and the output of the men is limited. Wages are very high, $5 and $6 a day being the prevailing wages. The calkers at the navy yard received $5 a day and they seldom ever reached in output the limits set. I was satisfied that the output was far too low, but for a long time was unable to increase it.

Finally, after educating some men who could take the places of the calkers in case of trouble, and carefully ascertaining the amount that a first-class man should do, I fixed a piece-work price which would allow the men to make from 50 to 60 per cent. more than their day's wages and put all work on piece work. To enable these men to earn the 60 per cent. above day wages, it was necessary for them to do 3½ or 4 times as much as was being accomplished at day work. The situation was finally accepted and in a few weeks the men were actually doing from 3 to 4 times as much as was done before. It is now necessary, on account of the large output, to employ but a small number of men, and these are the very best of their class. They make large wages, are perfectly contented, and never give the management the slightest trouble. The output now obtained is far above that obtained in other establishments in the vicinity and I believe exceeds the output obtained in eastern establishments. The average output for representative classes of work is as follows:

NEW WORK.

Decks, three threads	380 feet in 8 hours.
Sides and bottom, four threads	265 feet in 8 hours.

OLD WORK.

Reave out putty, harden down, and calk one thread	425 feet in 8 hours.
Reave out glue, harden down, and calk one thread	380 feet in 8 hours.

In the Machine Shop

An investigation was made of conditions in the machine shop and these were found to be about the same as those described in the boat shop. Owing to changes made in this shop, costs were greatly reduced. The conditions and the steps taken to reduce costs and increase output were fully described in the American Machinist, Volume 31, Part 1, pages 568, 610, 645.

Boiler Shop

Conditions were known to be very bad in this shop. The foreman was not in sympathy with any changes and resisted efforts made to improve the efficiency. The aim appeared to be to employ as many high-priced boilermakers as possible, regardless of expense. Under these conditions every change had to be considered with the greatest care before be-

ing put into effect. An assistant who had considerable experience in handling men, and who was endowed with much patience and tact, was put in the shop. This assistant, F. W. Becker, was my representative in the shop and was given full authority to make changes. He was directed to fully study the situation before making his first change and to consult me daily regarding proposed measures.

It was decided to take one job, the retubing of three water-tube boilers of the small-tube type and show what could be done by improving methods. In other words it was considered necessary to make a demonstration that everyone could see before beginning a complete reorganization of the shop. The results obtained were far beyond our expectations. A full description of the conditions found and the changes made cannot be given for lack of space. Generally the operations were made to follow each other in logical order, the tubes coming in the door and going from operator to operator until they reached the boiler. Proper tools and equipment were supplied, machine work replaced hand work, helpers and boys replaced boilermakers for the inferior work, each man's work was carefully planned and a definite assignment of work made, daily records were kept of the exact amount of work accomplished by each man, and all waits were eliminated. No attempt was made to drive the men, but the operations were so arranged that *the work* shoved the men; each operation had to keep ahead of the operation behind and if this was not the case it immediately showed up.

A detail record of the time and cost of each operation was made. These records are of much interest, particularly as some of them showed such tremendous reductions in cost that they have been questioned. The man who has been outdistanced always questions the record of the man who has defeated him. One operation, the cutting out of the old tubes, has caused considerable comment. There were 4600 1⅛-inch and 1¼-inch, No. 11, B. W. G. tubes in the three boilers; and two cuts were required to remove the tubes, one at the top drum and one at the lower drum. Six expert chippers, working in pairs, cut out the tubes, and to each pair there was a helper to remove the tubes. The 4600 tubes were cut out, removed from the boiler, and piled by these men in 7½ hours. *This was at day work; not piece work.*

The other operations show equally as satisfactory results. The time taken previously to retube three boilers in the shop was from 80 to 90 days, and the direct cost was about $1100 per boiler. The time taken under the changed conditions was 15 days and the direct cost was a little over $400 per boiler.

General Improvements

It has been my experience in navy-yard work that every job which I have carefully analyzed could be greatly reduced in cost, and in many cases the cost could be cut in half. Numerous examples can be given of the actual reductions that have been made. When the results obtained are mentioned those prone to criticize say that they were obtained by making a specialty of the job. If it is making a job a specialty to carefully analyze the work, provide the best facilities possible, arrange the work in logical order, utilize men best suited to the work, fix responsibility for quantity and quality of work, and increase the output, then I strongly advocate specialties and hope that all of the work done under my supervision will be of this class.

Reductions in Cost Can be Made in Commercial Concerns as Well as in Government Establishments

It may be assumed that such enormous reductions in cost can only be made in a Government establishment, and that conditions in a commercial establishment could not be so bad as to permit of such large reductions in cost. In the commercial establishment, it may be assumed that the keen competition would long ago have proved that something was wrong, and the difficulty would have been located and corrected. It may be assumed that a commercial establishment could not exist and pay dividends with such large leaks; that it would have long ago gone under if such conditions had existed. These assumptions are not correct.

There are many capable engineers, capable managers, who visit many prosperous establishments which are paying good dividends and see during a casual tour of the shops many spots where important improvements can be made, many places where there are glaring wastes. In some establishments so many cases are seen that the visitor wonders how it is possible that the setablishment can keep afloat. The very fact that the concern is paying a satisfactory dividend is, in many cases, responsible for the conditions, the reason that the leaks are not stopped and the methods improved. The managers or owners are satisfied with the profits, they themselves believe that there could be little wrong as long as such good dividends are earned. The reason for the payment of dividends is probably due to natural advantages, or the conditions of the trade. To these advantages there should be added the advantages of an economical administration, the advantages of scientific management, not only because of the increased profits, but to stop unnecessary waste of human endeavor. It is, however, difficult to persuade an owner or manager to make changes in organization or methods as long as the financial statement shows a satisfactory profit year by year. This is another foe to the advancement of scientific management.

A short time ago I visited a large establishment that employs several thousand men. In one of the large machine shops of this establishment modern shop methods and modern shop organization are unknown. The tools are not running nearly to their capacity, belts are in bad condition, work is done in machines unsuited to the work, work is not routed to the machines, the small-tool equipment is poor, too much finish is left on castings, and everywhere there was seen a wonderful field for improvement. I knew one of the high officials in the company, so I felt privileged to tell him what I had seen. To my surprise he told me that he had been told the same story before. "In fact," he said, "every one who comes here who is competent to judge and who feels privileged to speak has told me the same."

He explained that his company was building and installing machinery at a lower cost than its competitors. The superintendent of the machinery department resented any interference with his department and disliked changes, and if radical changes were made they would probably lose the superintendent, and he would be hard to replace. He added that as long as they were able to install machinery at less cost than their competitors he feared no improvement could be made over the poor methods. There is no doubt that this superintendent had marked ability in some lines, but he knew very little about modern shop methods or management. The low costs were largely due to natural advantages and low wages prevailing in the district in which the plant is located. The foe to the advancement of scientific management in that plant is "let well enough alone." It is a happy family and no one wishes to disturb the existing calm. This is a potent foe to advancement and is doing much to retard the development of the science of management. There is not the slightest doubt that the profits of this concern can be largely increased, but to do so will require some radical changes which will result in breaking up the happy-family management, and no one desires to originate the shaking up that is needed, as long as the dividends are satisfactory to the owners.

Will Scientific Management Become General?

It must be admitted that at present the majority of establishments are not managed in accordance with the principles of scientific management. No doubt progress for some years will be slow, but the seed has been sown and here and there will be found a manager or owner who believes in the science of management and who has the courage of his convictions and is willing to invest his money in this type of management. In a few years the reward will come in large profits, and competitors will be forced to adopt the same system; it will then be but a short time until scientific management will be the rule and not the exception.

Handling Gears on Internal Grinder

Special Correspondence

The handling of gears on the internal grinder presents some very interesting operations.

Other work also rapidly and economically accomplished on this type of machine.

The illustrations show some interesting methods of handling work on the internal grinder built by the Heald Machine Company, Worcester, Mass.

The headstock of this grinder is adapted for holding a draw-in collet arrangement when required and a part of this device is illustrated in Fig. 1, which shows a method of holding spur gears while grinding the bore. The collet or chuck consists of the body *A*, which is threaded to fit the nose of the spindle and provided with a conical seat to receive the taper sleeve *B*, which is split in three or four places and fitted with false jaws *C*, the latter being held in position by the fillister-head screws shown in the section. The chuck is operated to grip or release the work by a handwheel at the rear end which, when rotated, draws the chuck back into its seat or releases it for the removal of the work.

The false jaws *C* may be made of various diameters to admit work larger than the regular capacity of the draw-in collet.

Fig. 2 represents a similar chuck in which the gear is located and held by three rolls or pins placed 120 degrees apart and adapted to locate the gear by the pitch circle. These rolls, it will be noticed, are fitted with sufficient freedom in the holder *C* so that while their peripheries are in contact with the internal wall of *C*, they still allow for any slight variation which might be found in different gears due to the hardening process.

In Fig. 3 is illustrated the method of holding a long sleeve or bushing in the draw-in chuck. Fig. 4 shows another form of draw-in collet for holding gears having two diameters on the one piece. This provides for truing up both diameters at the same time so that the bore shall be practically concentric with both gears. It is assumed, of course, that with this method of holding the double gear there is not much variation in the outside diameters from piece to piece.

The fixture in Fig. 5 is screwed on the nose of the spindle and is adapted for holding bevel gears in order that the teeth shall run true according to the pitch line. The drawing shows three taper rolls placed 120 degrees apart and arranged to fit between the teeth in order to locate the gear from the pitch circle. The taper rolls can be made to fit the entire length of the teeth on the gear and are so secured that a slight variation in the gear due to hardening is fully taken care of.

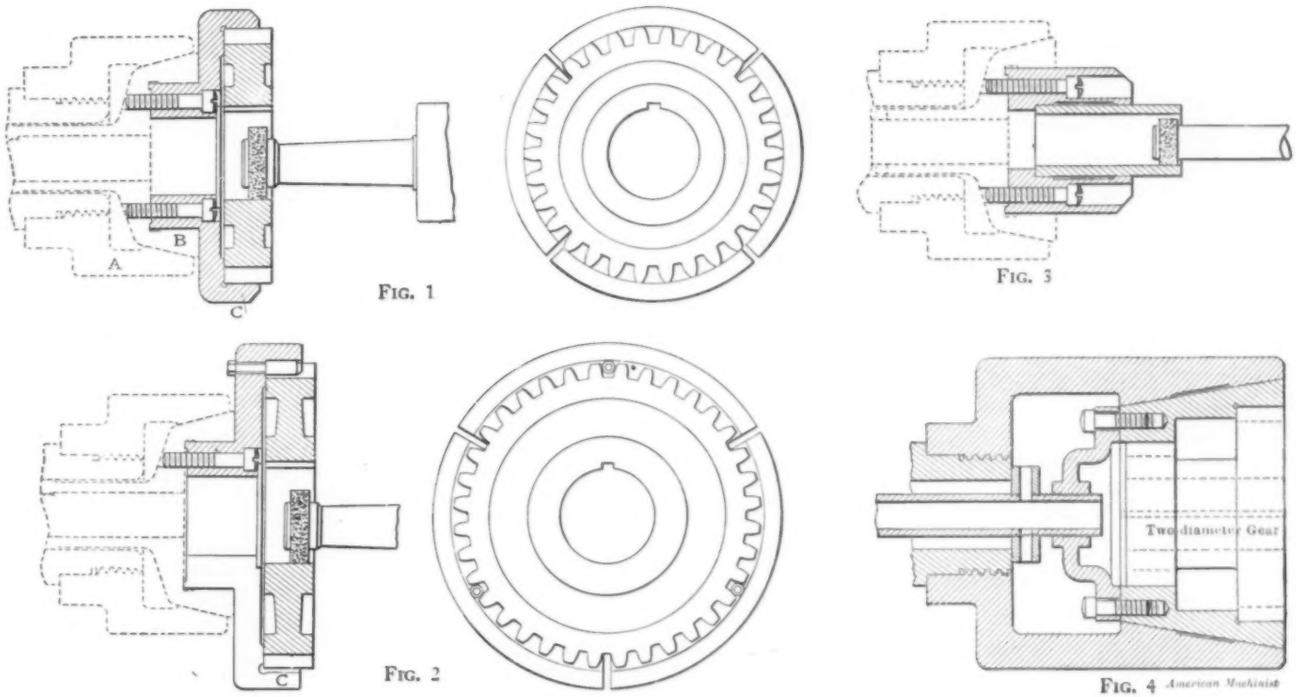


Fig. 1 Fig. 2 Fig. 3 Fig. 4 *American Machinist*

Holding Gears and Other Parts for Internal Grinding

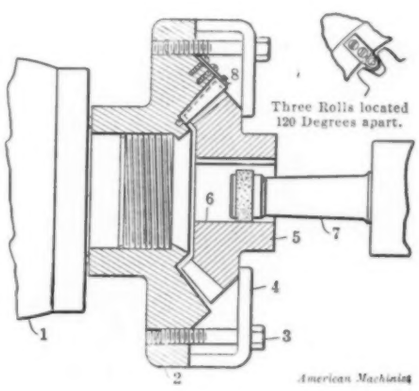


Fig. 5. Fixture for Holding Bevel Gear on Grinder

Examples of Pressed Steel Work

By E. A. Dixie

The examples of work shown in Figs. 1 and 2 were produced by the Worcester Pressed Steel Company, Worcester, Mass.

Fig. 1 shows elevations and plans of the eleven operations necessary to produce one-half of a pressed-steel gear case for an automobile. The material from which these parts are made is bright cold-rolled, open-hearth, annealed, soft-strip steel, 0.187 inch thick. Two of these half cases are required for each housing. All the drawing is done cold and but three annealings are necessary from the blank disk to the last operation. The approximate dimensions of the finished housings are 12 inches diameter by 8 inches deep.

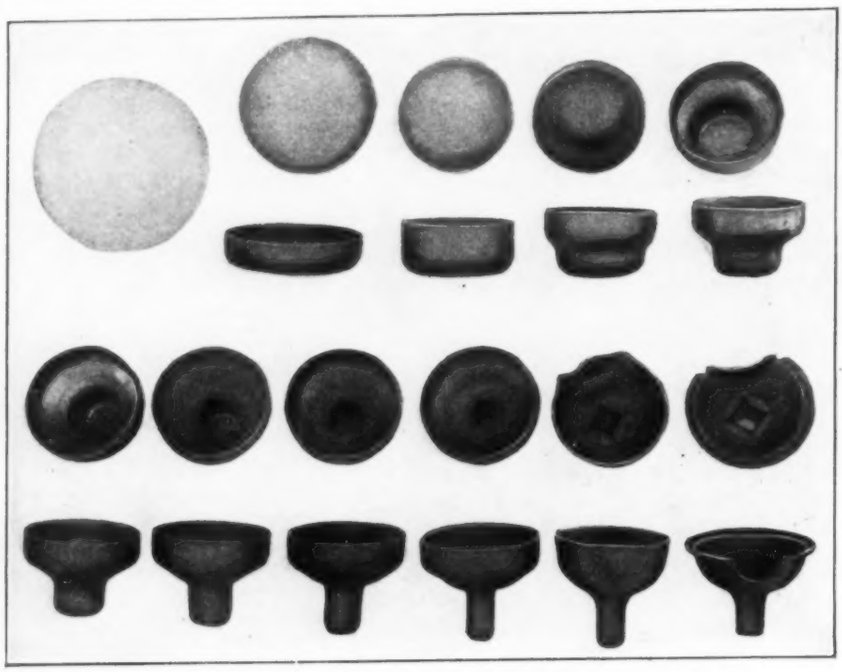


FIG. 1. THE DRAWING OPERATIONS ON A STEEL GEAR CASE

Fig. 2 shows front and back views of two machine bases. The one to the right is cast iron and weighs 38 pounds. The one to the left is pressed steel and weighs about 14 pounds. They are 19 inches high and measure 12½x18 inches at the bottom.

The steel base is practically a duplicate of the cast-iron base, except as regards weight. It is made in halves and double-seamed together after which the seams are sealed by autogenous welding.

The holes for floor screws, hinge lugs, hand hole, etc., are all reproduced in the steel bases exactly the same as in the cast bases, and the pressed bases are much more uniform than the castings. An important consideration and advantage in using pressed-steel bases in place of castings in this particular case is the saving in weight for transportation. This amounts to about $10,000 per year because of the large quantities of these bases used. The steel bases are easier to assemble, owing to their being interchangeable; they are easier to finish, paint or enamel than cast iron and are not easily broken. They offer a striking suggestion of many purposes to which pressed steel might be put to replace castings or forgings.

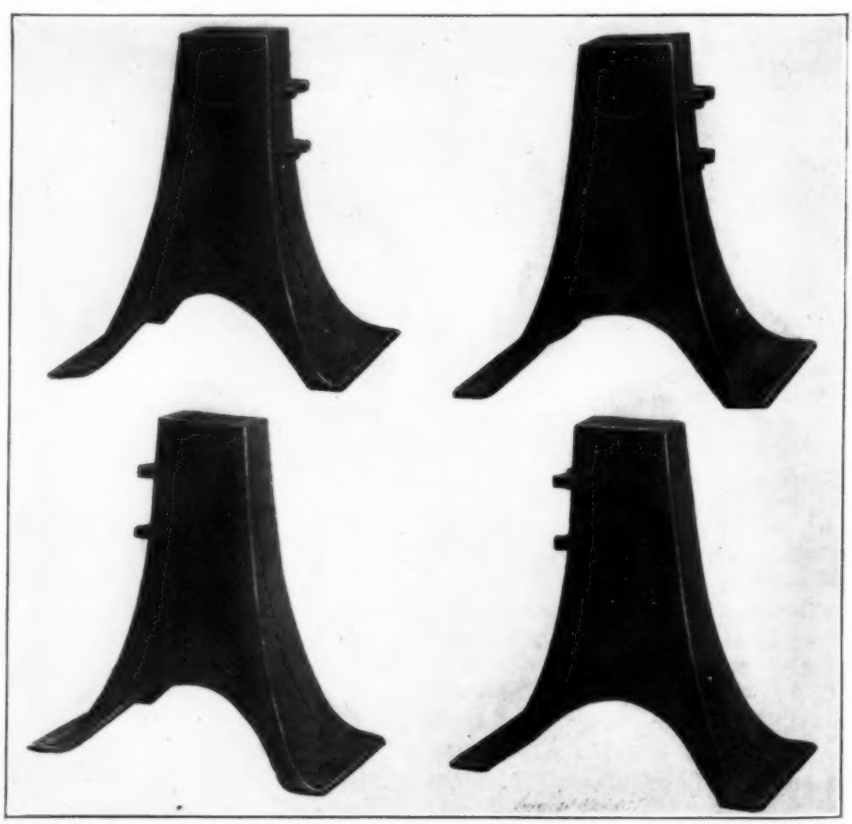


FIG. 2. A PRESSED-STEEL MACHINE BASE

A Remarkable Car Wheel Turning Record

A remarkable day's run of a Pond 42-inch motor-driven car-wheel lathe was recently made at the West Albany shops of the New York Central Railroad. The work was 36-inch Krupp and Paige wheels and in 9 hours and 53 minutes 33 pairs of wheels were turned out; the average time being 17 minutes and 38 seconds per pair. The depth of cut varied from ⅛ to ½ inch, averaging about ¼ inch while a constant feed of 13/32 inch per revolution was maintained.

These tests are tabulated by operations in the June issue of the *Progress Reporter*, published by the Niles-Bement-Pond Company and the uniformity in most cases is rather striking. The cutting speed varied from 10 to 20 feet per minute, with an average of 14.4 feet. The table affords an interesting study in many ways.

Analyzing Vertical Turret Lathe Work

Editorial Correspondence

The prospective customer receives a blueprint showing the settings of turrets and tools, depth of cut, feed, speed and time, to fractions of a minute, for every operation in making the piece that he submitted.

The firm that specializes at all in machine-tool building is met with the necessity of carefully preparing estimates of the machining time for various pieces submitted by prospective customers. These estimates must be right. If too short, the builder will be unable to "make good" when his machine is set up in the purchaser's factory. If too long, he is at a disadvantage with his competitors. That intelligent detailed analysis of every operation is the only basis for such estimate, no one will dispute.

Tables 1 to 3, inclusive, and Figs. 1 to 25, inclusive, show the form in which estimates for turret-lathe work are prepared and sent out by the Bullard Machine Tool Company, Bridgeport, Conn. The originals are made on tracing cloth and the customer receives blueprint copies.

Operations on a 16-inch Flywheel

A section of a 16-inch flywheel is shown in Fig. A, with general dimensions and lettered surfaces. In Table 1 is given a detail of the operations for machining this wheel in a vertical turret lathe, with the depth of cut, feed and speed, for each operation, and the number of minutes required to do it. Several operations are done at the same time, and the last column gives the number of minutes that are actually required to machine the piece. The turret and tool layouts for these operations are shown in diagram in Figs. 2 to 11, inclusive. Figs. 2 to 9 show the operation for the first setting, and Figs. 10 and 11 for the second.

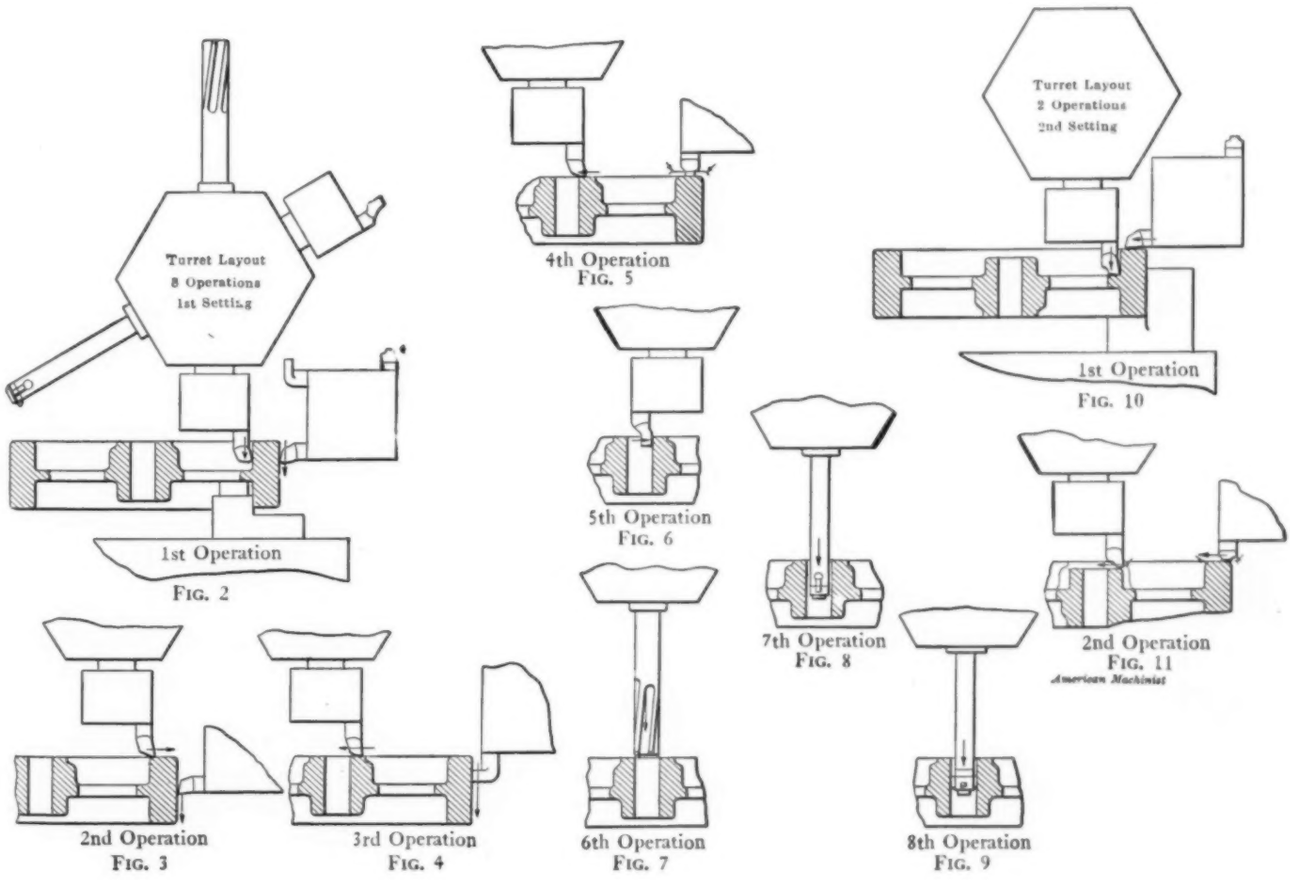
Returning to Table 1, the total number of minutes for all the operations is 23, and the number of minutes required to machine the piece is 17. That is, six minutes of actual machining time are saved by using the second turret and performing several operations simultaneously. In percentage this is a very real factor, 26 per cent. The former lathe time on this piece was four hours.

A Nine-inch Gear Blank

Fig. B shows in section a gear blank; Table 2, the corresponding list of operations, and Figs. 13 to 17, inclusive, the layouts of the turrets and tools. But little comment is necessary, except to point out that the total number of minutes for all operations is 9¼, and the number of minutes required to machine the piece, 6¾; a reduction of 27 per cent.

A 21-inch Gear Blank

In Fig. C is a larger gear blank, shown in section, dimensioned and lettered as before. The corresponding schedule of



Turret and Tool Layout to Machine a 16-inch Flywheel on a Vertical Turret Lathe

Setting Number.	Operation Number.	Operation.	Surface Machined.	Depth of Cut.	Feed per Revolution.	Revolutions per Minute.	Minutes Each Operation.	Minutes Actually Required.
1		Chuck					1¼	1¼
	1	Rough turn, Rough bore, Rough face — simultaneous cuts	A, B, C	⅜	0.111	12–18	3½	3½
	2	Rough face	D	⅛	0.056	18	2	
	3	Rough face, Finish turn — simultaneous cuts	A	⅛	0.333	18	1	1
	4	Finish face, Round edges — simultaneous cuts	C	⅛	0.333	18		
	5	Counterbore	E	⅛	0.056	62		
	6	Core drill	E	⅜	0.111	62	1	1
	7	Truing cut	E	⅛	0.027	62	2	2
	8	Ream	E	0.005	0.111	62	1	
	9	Remove						
2		Chuck					1½	2
	1	Rough bore, Rough face — simultaneous cuts	G, F	¼	0.111	18		
	2	Finish face, Round edges — simultaneous cuts	F					
		Face	H				1	
		Remove						
		Total time (individual operations)					23	
		Actual time						17

TABLE 1. ANALYSIS OF OPERATIONS FOR MACHINING 16-INCH FLYWHEEL IN VERTICAL TURRET LATHE.

Setting Number.	Operation Number.	Operation.	Surface Machined.	Depth of Cut.	Feed per Revolution.	Revolutions per Minute.	Minutes Each Operation.	Minutes Actually Required.
1	1	Chuck						
	2	Rough turn, Rough face, Rough face — simultaneous cuts	A, B, C	⅜	⅛	26	1	1
	3	Rough bore, Round edges — simultaneous cuts	D	⅛	⅛	26	1	1
	4	Truing cut	D	1/64	1/16	26–30	1	1
		Finish turn, Finish face, Finish face — simultaneous cut	A, B, C	0.005	⅛	26		
	5	Ream	D	0.005	⅛	26		
	6	Remove						
2	1	Chuck						
	2	Rough face	E & F	⅜	⅛	26		
	3	Finish face	E & F	1/64	⅛	26		
	4	Round edges				26		
	5	Remove						
		Total time (individual operations)					9¼	
		Actual time						6¼

TABLE 2. ANALYSIS OF OPERATIONS FOR MACHINING 9-INCH GEAR BLANK IN VERTICAL TURRET LATHE.

Setting Number.	Operation Number.	Operation.	Surface Machined.	Depth of Cut.	Feed per Revolution.	Revolutions per Minute.	Minutes Each Operation.	Minutes Actually Required.
1	1	Chuck						
	2	Rough turn, Rough face, Rough face — simultaneous cuts	A, B, C	⅜	0.111	8	3	3
	3	Finish turn, Finish face, Finish face — simultaneous cuts	A, B, C	0.005	0.333	8	1½	1½
	4	Rough bore, Round edges — simultaneous cuts	D	⅛	0.111	45	2	2
	5	Truing cut	D	1/64	0.056	53	1	1
	6	Ream	D	0.005	0.216	30.7		
	7	Remove						
2	1	Chuck						
	2	Rough face, Rough face — simultaneous cuts	E, F	⅜	0.111	8	1	1
	3	Finish face	E	1/64	0.333	8		
	4		F	1/64	0.333	8		
	5	Round edges						
	6	Remove						
		Total time (individual operations)					19¼	
		Actual time						13

TABLE 3. ANALYSIS OF OPERATIONS FOR MACHINING 21-INCH GEAR BLANK IN VERTICAL TURRET LATHE.

operations in Table 3, and the diagrams showing the layouts of turrets and tools, are Figs. 19 to 25, inclusive. Here the machining time is 33 per cent. less than the total of the time for all the operations. The reduction in minutes is 6¼, or from 19¼ to 13.

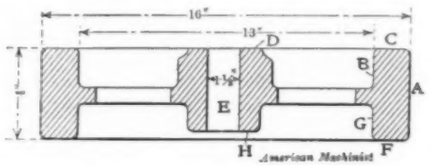


FIG. A. SECTION OF 16-INCH FLYWHEEL

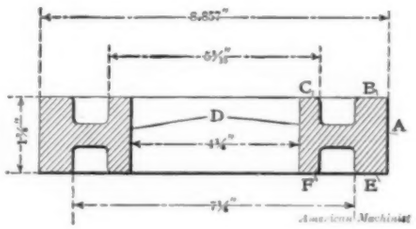


FIG. B. SECTION OF 9-INCH GEAR BLANK

These analyses have shown the truth of the saying, that there is no lower limit for the machining time on a given piece. After a schedule of operations has been made out and a piece machined according to it, changes in methods, or setting, or tools may suggest themselves, whereby time can be saved. This is no reflection whatever upon the original

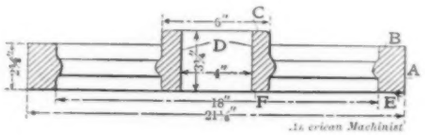


FIG. C. SECTION OF 21-INCH GEAR BLANK

analysis, but merely shows that progress in machining methods constantly presents new possibilities for doing work quicker and better.

The Norden Propeller

There has been recently demonstrated in New York City a new type of propeller for sea-going vessels, which is the invention of F. F. Norden, a native of Sweden. These propellers are designed to run in a compartment constructed inside the stern of the vessel, which prevents the propeller being damaged by striking floating objects and also allows it to be repaired or replaced without putting the vessel into dry dock. It is also claimed to produce less vibration to the

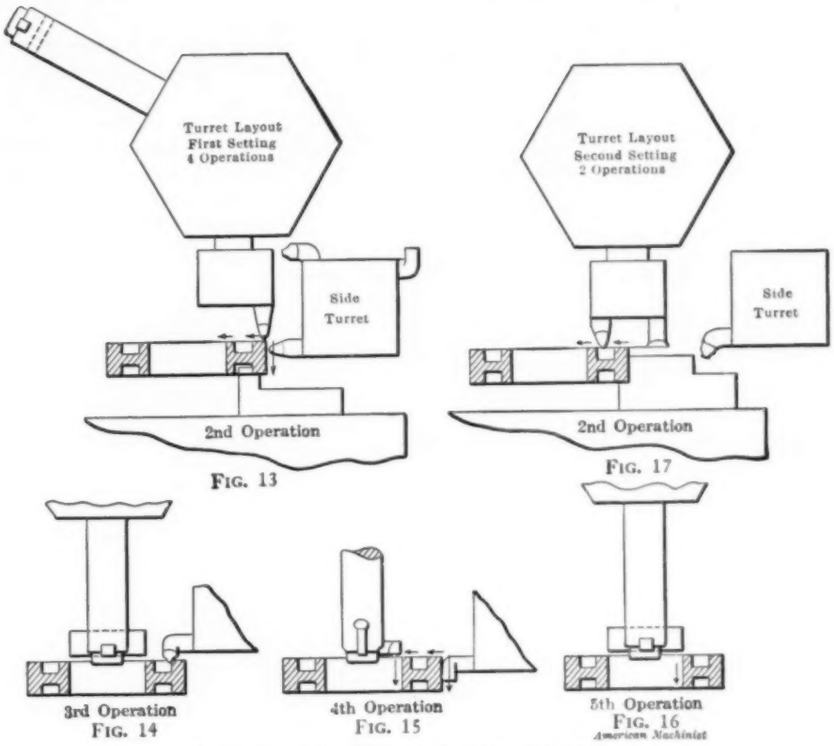


FIG. 13 FIG. 17

FIG. 14 FIG. 15 FIG. 16

LAYOUTS TO MACHINE A 9-INCH GEAR BLANK

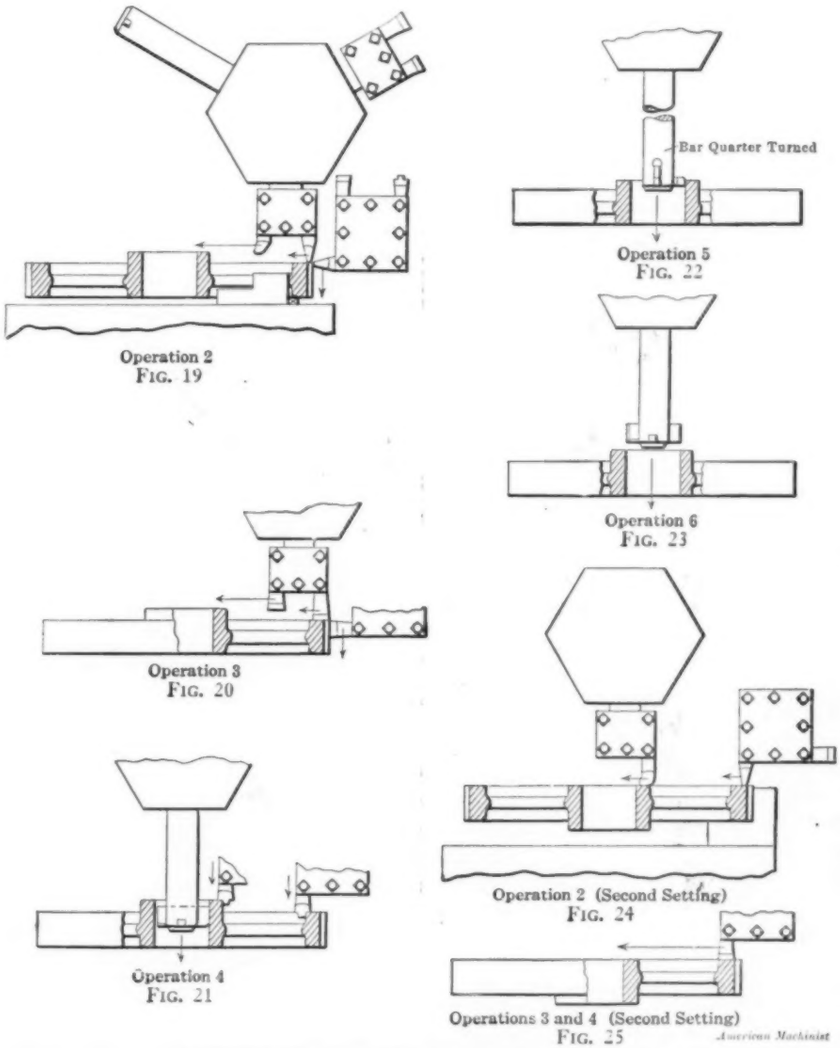


FIG. 19 FIG. 22

FIG. 23

FIG. 20

FIG. 24

FIG. 21

FIG. 25

LAYOUTS TO MACHINE A 21-INCH GEAR BLANK

vessel, as well as to give increased speed. The propellers are helical in shape and may be used singly or in any number desired.

Locomotive Testing Plant Presented to the University of Illinois

Upon the recommendation of Robert Quayle, superintendent of motive power and machinery, and with the approval of W. A. Gardner, general manager, the locomotive testing plant of the Chicago & Northwestern Railway Company has been presented to the University of Illinois. Under the immediate direction of H. T. Bentley, assistant superintendent of motive power and machinery, it has been taken from its foundation, the bearings and other running parts have been put in good order for service, and the plant, with all the special patterns used in its construction, has been loaded and shipped to the University of Illinois. It is understood that the plant will be held by the university pending the construction of its proposed transportation laboratory.

This testing plant was designed under the general direction of Mr. Quayle, aided by E. M. Herr, now vice-president and general manager of the Westinghouse Electric and Manufacturing Company, but at that time assistant superintendent of motive power and machinery. The drawings were developed under the immediate direction of E. B. Thompson, now superintendent of motive power and machinery of the Chicago, St. Paul, Minneapolis & Omaha Railway, but who at that time was chief draftsman for the railway company.

The plant consists of foundation plates, pedestals and three pairs of axles with their bearings, supporting wheels, friction brakes, etc. It was the first of its kind to be supplied with permanent mounting rails, by use of which a locomotive could be rolled on or off the wheels without resort to temporary blocking.

It is announced by Dean Goss, of the College of Engineering, that the plant at the university will constitute a portion of the equipment of the School of Railway Engineering and Administration, and that when installed it will be operated under the immediate direction of Prof. Edward C. Schmidt, in charge of railway engineering.

In a report prepared by special United States Government agent, H. Studneczka, the production of artificial rubber by a German inventor is commented upon. The invention is based on the boiling together, under certain conditions, of isoprem with acetic acid, in a closed tube, the result being the creation of a gray composite possessing all the properties of pure rubber and capable of being vulcanized in the same manner as gutta percha.

German Electric Welding Machines

By Bruno Loewenherz

A variety of electric welding machines, of the resistance type, adapted for manufacturing metal articles in quantities.

Special machines for doing different work showing an increased use of the welding process in commercial work.

There are two methods by which electrical welding can be performed, namely: Resistance and arc welding. The arc welding is chiefly used for repairing and remedying flaws in castings. Resistance welding, however, is acquiring a growing importance for the manufacture of all kinds of metal ware in quantities. The easy manipulation of resistance welding machines by unskilled labor, and their great adaptability to special purposes, have rendered possible the development of new working methods in many branches of industry. By their help, important economies of manufacture can be attained.

Butt and Spot Welding

In butt welding, the pieces are placed against each other, as shown by *A* and *B* in Fig. 1, and fastened in jaws *C*, which serve as current conductors, the dotted line *D* being the path of the current when heated. When heated they are pressed together. In spot welding, point-shaped electrodes press the pieces of work together between them, as shown in Fig. 2.

The welding machines are supplied with alternating current and contain a transformer, which lowers the voltage to, from one to three volts. By this means currents of many thousand amperes are often produced. The low potential in the electrodes renders the operation of the machine completely free from danger.

The electrodes of most welding machines contain hollow chambers traversed by cooling water, because, especially in forced work, there are developed great quantities of heat, which must be removed from the interior of the machine to obtain the greatest efficiency.

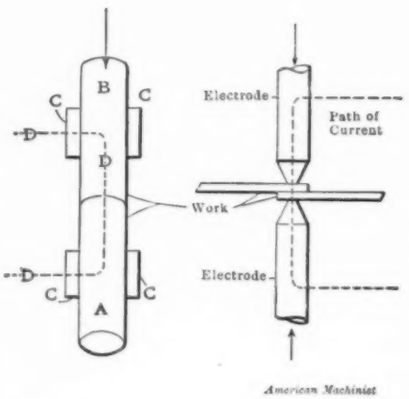


Fig. 1. Butt Weld

Fig. 2. Spot Weld

Butt Welding Machines

In Fig. 3 is shown a butt-welding machine while welding a round piece of metal. The two levels above clamp the pieces of work in the electrode jaws. One of the two clamps is movable. After clamping the pieces, the workman turns the handwheel as shown, which moves the loose clamp and presses the firmly clamped pieces together, while simultaneously he depresses a foot lever and thereby switches on the current. In a short time the welding heat is attained and by means of the handwheel the workman squeezes the softened pieces together and turns off the current by releasing the foot lever.

A semi-automatic machine is shown in Fig. 4, as it is welding together a metal wheel rim. After setting up the work a lever is moved to turn on the current and a spring brought into tension against the

Fig. 3. Hand-operated Butt Welding Machine

Fig. 4. Semi-Automatic Butt Welder

work, so as to produce the thrust for welding. When this thrust has taken place, the current is automatically interrupted.

An automatic machine is shown in Fig. 5. The operator merely lays the pieces to be welded between the jaws and presses down the foot lever. By this

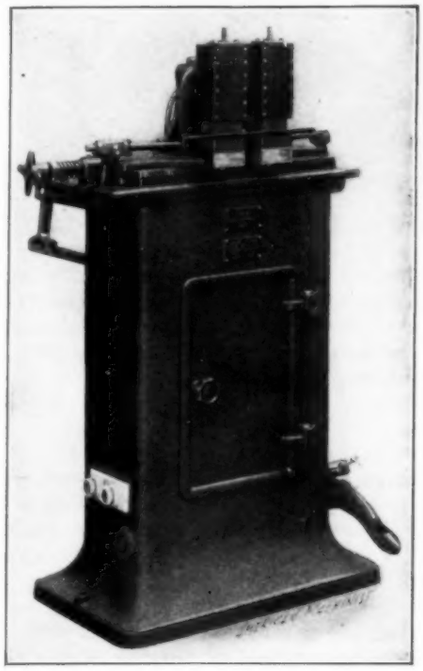


FIG. 5. AUTOMATIC BUTT WELDER

means, in sequence, the pieces are clamped, the current switched on, the pieces squeezed together, the current switched off, and finally, the work is released by removing the foot from the lever. These automatic methods enable the employment of unskilled labor.

SHAPE OF THE CLAMPS

For different kinds of work, the clamps of the machine are given an appropriate form to fit any shape of piece desired. A few examples will explain this. Fig. 6 shows how a round iron rod is clamped for welding to a tube. Instead of pressing stirrups out of a single piece, they can, by the aid of electrical welding, be made of two parts, as shown in Fig. 7. Projections on the lower plate afford sections of equal area at the places of welding. If it were attempted to weld to the arch, a plate without such projections, the electric current at the region of contact would pass from the large section to the small one, and produce an unequal heating of the two pieces, which would be detrimental to good and quick welding. In Fig. 8, in order to produce equal areas of metal, projections are pressed in the plate and the bent rod is welded to these.

In Fig. 9 is shown the method of clamping a horseshoe to weld the calk on it, and Fig. 10 shows the special machine that is used for this purpose. This machine closely approaches the spot-welding principle and may be used as such on some classes of work. Every individual piece that is to be welded is not chucked. Instead, the electrodes are pressed against the parts, by a hand-wheel, and clamp these together between them.

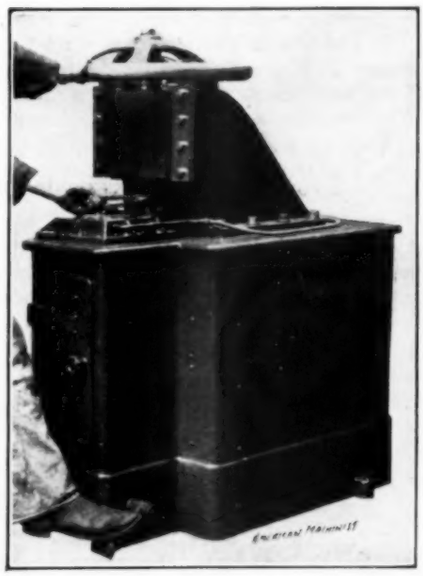


FIG. 10. HORSESHOE-WELDING MACHINE

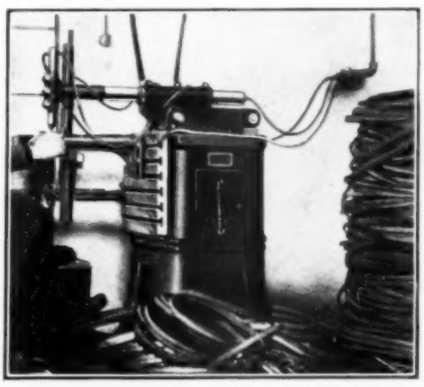


FIG. 13. WELDING WHEEL TIRES

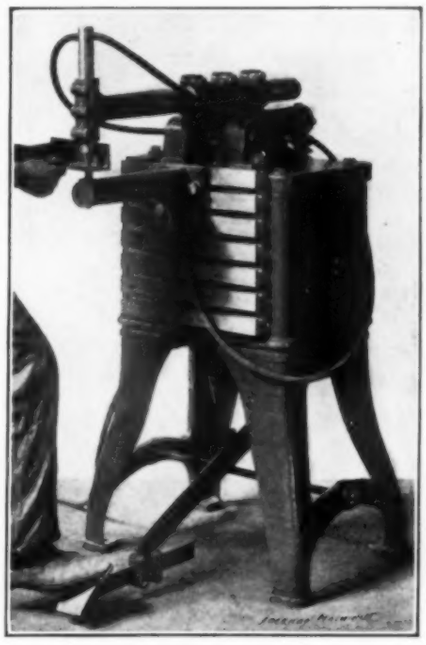


FIG. 11. SPOT-WELDING MACHINE

SPOT WELDING MACHINE

This machine is not used to weld full sections, but in general, to join sheets in spots as is done by rivets. The electrodes are shaped in accordance with the

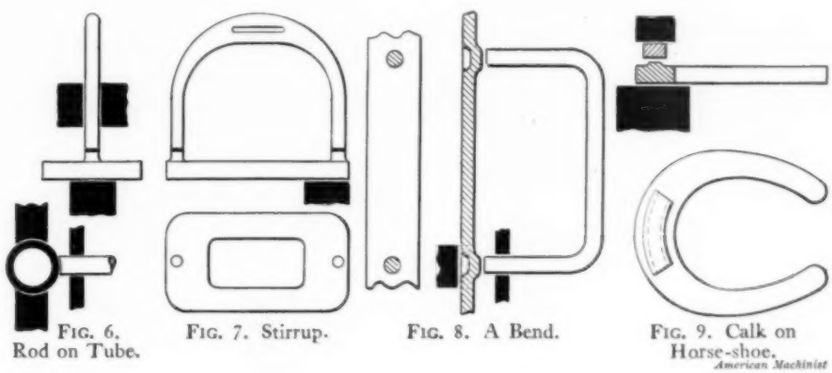


FIG. 6. Rod on Tube. FIG. 7. Stirrup. FIG. 8. A Bend. FIG. 9. Calk on Horse-shoe. American Machinist

CLAMPING IRREGULAR SHAPES FOR WELDING

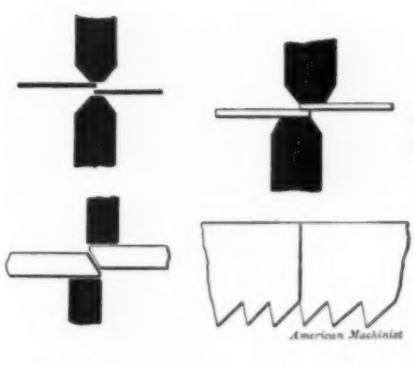


FIG. 12. WORK READY FOR SEAMLESS WELDING

FIG. 14. WELDING HANDLES ON COVERS

special work that is to be performed. Their simplest pattern is exemplified by the flattened points shown in the welding machine in Fig. 11. By a pressure upon the foot lever the workman depresses the upper electrode. The work is then pressed together between the two electrodes, and the current, automatically switching on, at low potential, welds the parts together at one point. After releasing the foot lever, the work can be moved along for welding at a new point. The entire process requires so little time that an unskilled workman is able to make 1000 welds per hour on plain sheets, while in the same time an experienced hand could put together hardly a quarter as many with rivets.

The up-and-down movement of the upper electrode, in another type of this machine is performed automatically by means of an electric motor. The electrode then falls and rises at regular adjustable intervals, and the workman only has to move the piece of work.

FIG. 15. WELDING RINGS ON POTS

SEAMLESS WELDING

This machine is also employed on water-tight welding. In this case the travel of the work takes place so slowly that the points of welding lie close together and form an unbroken seam.

The preparation of work for seamless welding is shown in Fig. 12. Since, in this sort of welding, the current has to traverse the small edge section of the plate, and therefore encounters a great resistance, the edges of the sheets are completely softened and are pressed together seamlessly. The arrangement of

FIG. 16. WELDING ARC-LAMP CASINGS

FIG. 17. ROLL ELECTRODES

a saw blade for seamless welding is also shown.

The following halftones show a few of the many uses that have been found for point-welding machines in the sheet metal ware industry. Fig. 13 depicts the seamless welding of wheel rims on the spot welder. If the material is not too thick and irregular shaped sections do not have to be dealt with, the complicated

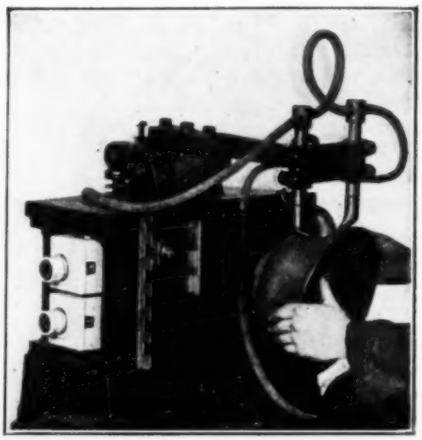


FIG. 18. TWO CURVED UPPER ELECTRODES

butt welding machine shown in Fig. 4 can be replaced by this one. Fig. 14 shows the welding of handles on covers, and Fig. 15 the welding of rings on cooking pots.

VARIOUS FORMS OF ELECTRODES

In this machine the electrodes are easily interchanged. The lower one is movable with its holder, in the T-slots to any position desired for a particular piece of work, and is set up once for all. The upper electrode can be tilted to any angle required and raised or lowered in its holder, as shown in Fig. 16 where the girl is welding electric lamp casings.

FIG. 19. WELDING TWO PIECES TOGETHER TO MAKE SPOUTS

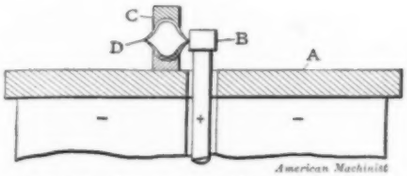


FIG. 20. SECTIONAL VIEW THROUGH CENTER OF TABLE

A special construction of electrodes is shown in Fig. 17. The lower one consists of a roll freely movable on its axis, while the upper one is formed of a circular piece of copper swung by lever. The form is useful for welding short seams, such as the triangular spouts on coffee pots, arc lamp casing parts that are welded before being formed, etc. Since the pressure put upon the material is extraordinarily high, there is hardly any difference in strength between the welded material and the unwelded.

In Fig. 18 is shown a special construction of electrodes for welding curved spouts on tea kettles. Two upper electrodes are used. One-half of this circular weld around the spout is made with each of the upper electrodes, alternately, by moving the carriage that holds the lower electrode back and forth in the T-slots.

WELDING HOLLOW PARTS

For welding the spouts themselves, consisting of two parts, the special seam-

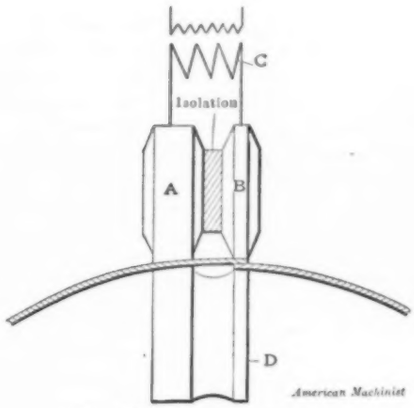


FIG. 23. ROLL ELECTRODES

welding machine, shown in Fig. 19 is used. This differs very essentially from the machines hitherto described and the details of construction are shown in Fig. 20. Through the middle of one electrode *A* which forms the table of the machine, projects the second electrode *B*, shaped as a pin. On the table is placed a form *C* in which are mounted the two parts of the spout *D*. The pin electrode is slowly revolved by a motor to weld the stamped fins togetner and thus the halves of the spout; at the same time the fins are pressed into the work so that a seamless weld is produced. The pin-shaped electrode carries at its base a pinion meshing with a rack on the carriage, whereby this carriage is automatically moved along.

FIG. 25. WELDING BUNG-HOLE FLANGE

The manufacture of small sheet-metal hollow ware with this machine presents very important advantages over the old method of forming seams.

To weld the handles on knives the electrodes are arranged as shown in Fig. 21.

MACHINE FOR WELDING CASKS

Of especial interest are the appliances for manufacturing iron casks intended to hold fluids under pressure. A set of welding machines is required for the various operations.

The machine in Fig. 22 is used for welding longitudinal seams. Two rotat-

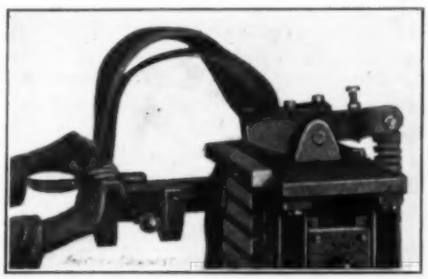


FIG. 21. WELDING HANDLES ON KNIVES

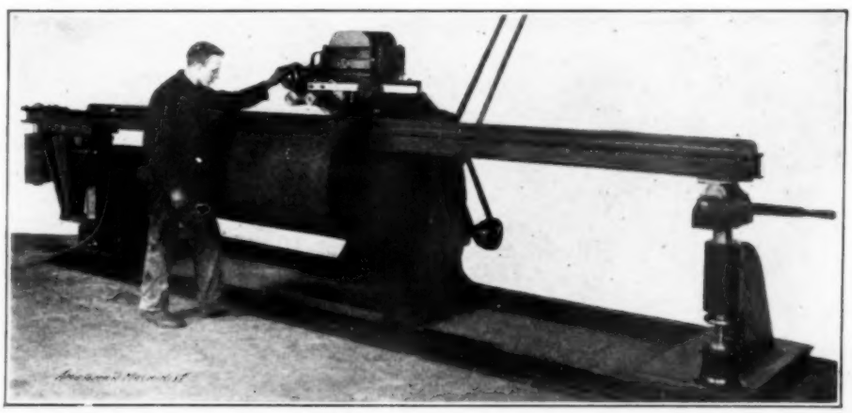


FIG. 22. SPECIAL MACHINE FOR ELECTRICALLY WELDING LONGITUDINAL SEAMS

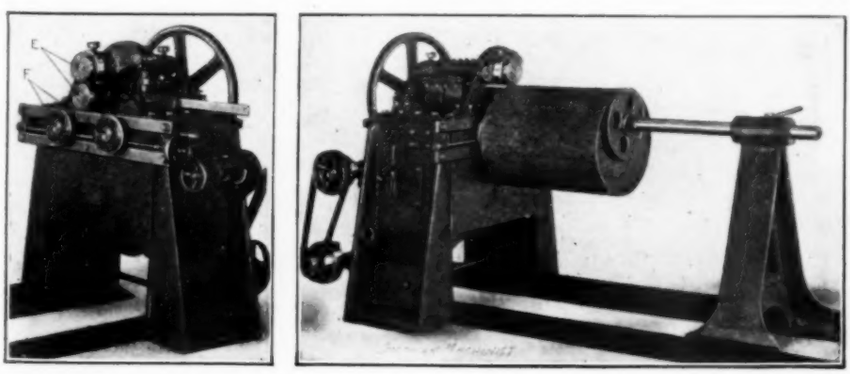


FIG. 24. TWO VIEWS OF MACHINE FOR WELDING ENDS IN CASKS

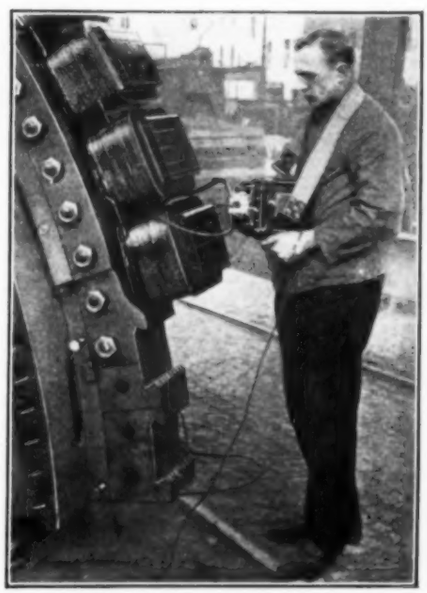


FIG. 26. PORTABLE WIRE WELDER

ing disks placed near together constitute the upper electrode, as shown in Fig. 23. This welding machine is based upon a patented process in which the two mutually insulated roll electrodes *A* and *B* are connected with the two ends of the secondary winding *C* of the transformer. The circuit is closed with the aid of auxiliary electrode *D* placed opposite the rolls inside of the cylindrical object that is being welded. The welding takes place only between *B* and *D*. The rolls *A* and *B* are motor driven and cause the work to travel.

To weld the bottom seams the machine shown by the two views in Fig. 24 is employed. Here also are the rotating electrode disks *E* between which the work moves. Two lateral guide rollers *F* placed under the electrodes, together with a movable holder on the other end of the machine, serve to guide the cask during the welding.

To weld on the bung-hole flange, a motor-driven point welding machine is used as shown in Fig. 25.

Portable Machine for Welding Wire

A special small portable machine working on the butt-welding principle is shown in Fig. 26.

This machine welds together wire ends. A simple pressure by the workman on a pincer-shaped clamping fixture suffices to grasp both wire ends, fix them fast, switch on the current, produce the thrust, and cut off the current automatically. The illustration shows it in service for joining coil ends in dynamo construction. With this machine may be welded copper wire up to 1/8 inch square and iron wire up to 5/32 inch.

There is hardly an industry, in which metal pieces are manufactured repetitively, that might not derive great benefit from the use of electrical resistance welding machines of the types shown above. Especially have the machines found service in locomotive and car works for welding axles, tires, hubs and wheel spokes; as well as in automobile works, bicycle factories, chain shops, etc. In the sheet-metal industry it has proved particularly useful for the production of enamel ware, hoop-iron ware and builders' iron work, and it is finding new applications every day.

Making Springs and Rockshafts

Editorial Correspondence

The large number and variety of springs used in an adding machine make a special machine for their manufacture desirable.

How the machine operates and the gaging methods used on rockshafts.

In building the adding machine made by the Comptograph Company, of Chicago, Ill., several different sizes and styles of coiled springs are required. These must be uniform in weight and tension and the company found it advisable to make a special spring-winding machine.

In Fig 1 is shown a group of different style springs that are used, while in Fig. 2 is shown the special universal spring machine on which all of these springs are made. In addition to the springs shown in Fig. 1, an open spring that is used on the keys and an answer-pawl spring are made.

In Fig. 2, the machine is shown as it is set up and making the open spring, and

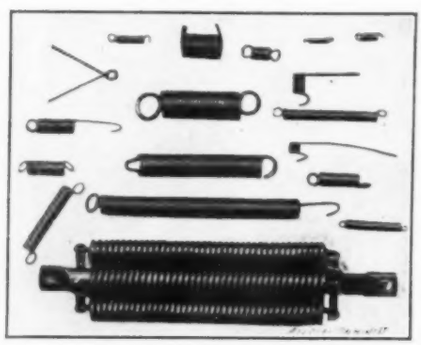


Fig. 1. Springs Used on Comptograph

in another illustration is shown the machine that is used for making the answer-pawl spring.

Universal Spring Machine

Two views of the universal spring machine are shown in Fig. 2, and in these the wire is taken from a coil and fed through clamp *A* onto arbor *B*, which is chucked in the spindle of the machine. On turning handle *C* at the end of the machine, the table *D*, with the grooved cam *E*, is moved forward and this in turn moves the cross slide *F* to regulate the pitch of the spring.

This method of moving the cross slide makes it possible to wind either a closed or open spring and also to get a fine adjustment of the tension. When the exact number of coils have been made, stop *H* automatically locks the spindle and the spring is cut off and removed by pulling out the spring tailstock stop *I*. Attachments for making the special ends on the springs are fastened to rod *J*.

Special-spring Machine

The special machine for making the answer-pawl spring is shown in Fig. 3.

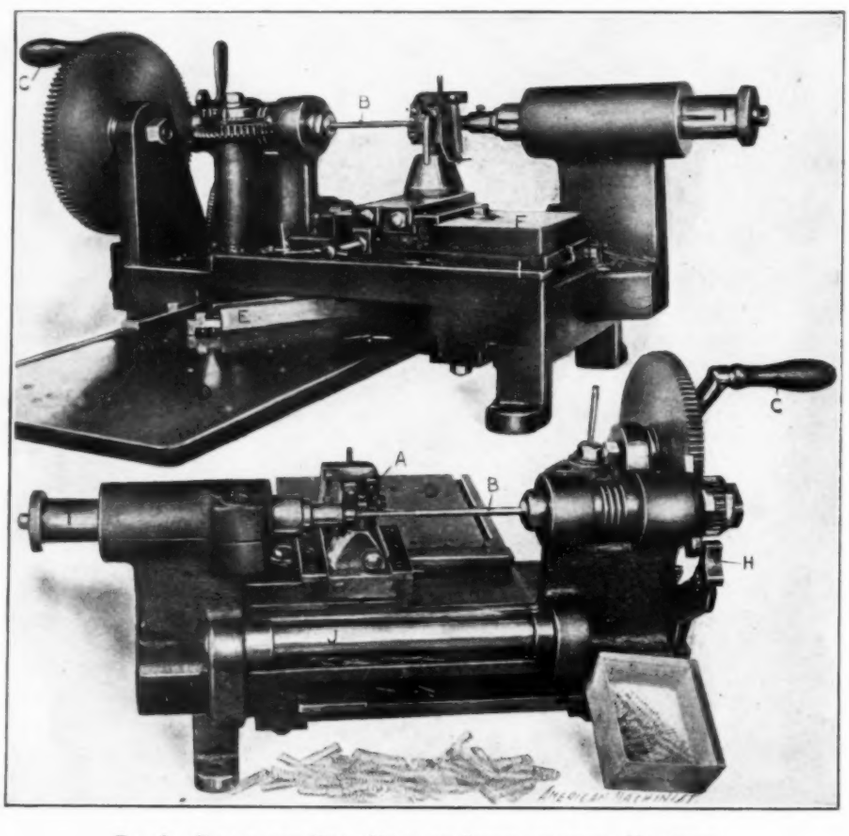


Fig. 2. Front and Rear View of Spring-making Machine

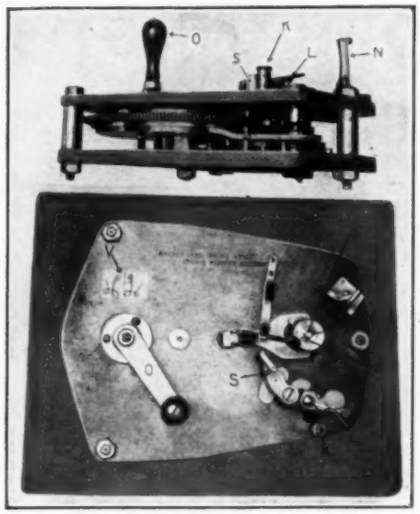


FIG. 3. TOP AND SIDE VIEW OF ANSWER-PAWL SPRING MACHINE

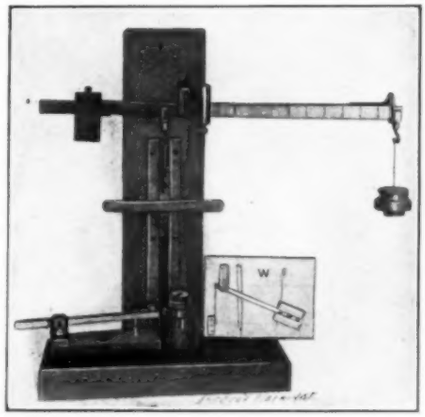


FIG. 4. SPRING-TENSION TESTING MACHINE

An idea of the shape of this spring can be obtained by the two springs shown at *V*. A wire is sent from a coil through oiler *K*, and friction device *L*, onto arbor *M*. The starting lever *N* is put down and the crank *O* is turned 7 times to make a complete spring.

When the wire is started and the handle turned, it takes two turns around arbor *M*, then arbor *P* comes up and arbor *M* is lowered enough to clear the wire. It then makes two turns around arbor *P*, when this is lowered and arbor *R* comes up for two turns to be made around it. The combination forming and cutting-off device *S* then moves forward to perform its operation on the wire. With the exception of starting the wire, these operations are controlled by crank *O* and are performed automatically. Thus, by turning crank *O* seven times, completes a spring and cuts it off and it has a special shaped end and requires three different kinds of arbors on the winder. With this machine a boy can make 1500 answer-pawl springs in a day.

TESTING SPRINGS

In order to be assured that the tension is correct the springs are weighed and tested in the scales shown in Fig. 4. The larger scale at *T* tests about 94 per cent. of the springs heretofore shown, by weighing the tension. The open springs are tested by compressing them in the tool shown at *U*, and the small springs are tested by the apparatus shown at *W*. This has an indicator pointer attached to the beam of the scale and this must point to the line inscribed on the plate before the spring is accepted.

In Fig. 5 is shown a mill fixture for milling the periphery of the numeral wheel index. An idea of the size and shape of these is obtained from the three pieces shown standing on the projection of the jig in the right of the illustration. The outside diameter of this piece is about ¾ of an inch and it has a thickness of 0.04 inch. It is forged from crucible steel.

The piece is held on a vertically mounted revolving spindle that is revolved by a worm and worm gear. It is

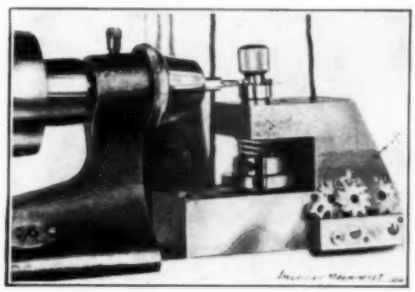


FIG. 5. MILLING PERIPHERY OF NUMERAL WHEEL

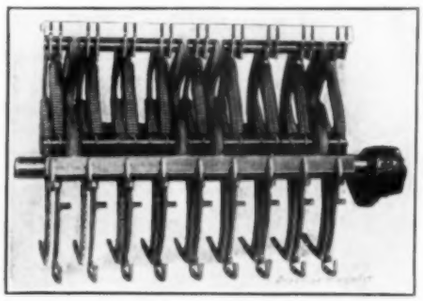


FIG. 6. THE ADDING ROCK SHAFT

raised and lowered by a cam on the spindle so as to accommodate the projection at *X*. It is also necessary to raise and lower it owing to all of the teeth not being of the same width. The machining is done by a small end mill mounted in the center.

ROCK SHAFT

One of the most vital sections of the adding machine is the rock-shaft unit shown in Fig. 6. This section is made interchangeable so that at any time a rock-shaft unit can be removed and a new one put in its place without the necessity of a refitting.

In order to insure interchangeability, the rock-shaft unit, after it has been assembled, is gaged as shown in Fig. 7. In

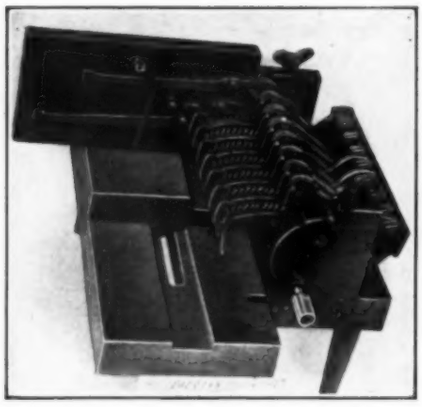


FIG. 7. GAGING THE ROCK SHAFT

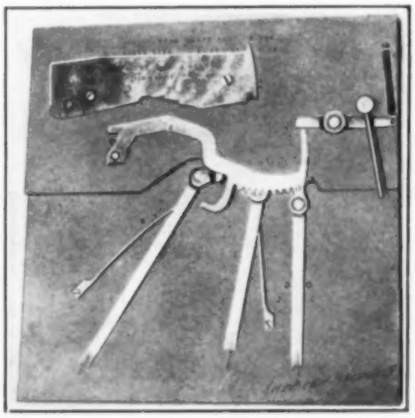


FIG. 8. GAGE USED ON ONE PART OF ROCK SHAFT

this a slide carries a plate on which are located the indicators and this enables the gage to be moved across the rock-shaft and gage each one of the arms separately. Several points are gaged with this and the pointers must point exactly to the line on the plate before the rock-shaft unit can be accepted for assembling in the machine.

One of the gages that is used on one part of the rock-shaft is shown in Fig. 8; this gages three different places on the piece.

In a series of tests conducted at the engineering-experiment station of the University of Illinois to obtain the best type of base-plate cushion for distributing the pressure of the plates uniformly over the liner surface, after many experiments a satisfactory cushion was finally found which was composed of 11 layers of oak pieces, cut 24x3x⅞ inches, piled in crosswise layers, leaving ¼-inch spaces between the pieces to permit expansion. This cushion proved to be sufficiently elastic and also able to sustain pressures sufficient to break the cast-iron plates. It supported without great injury a load of 620,000 pounds, or 31 times the safe pressure for which the plates were designed. Any injured pieces could easily be replaced in order to maintain the efficiency of the cushion.

Large Tools for Railroad Shops

Special Correspondence

Eight new tools brought out specially for railroad work.

Several of the machines possess features decidedly new and interesting.

As much of the work of the railroad shop is of a special nature, there are certain special tools on the market which are designed particularly for this class of service. The accompanying illustrations show eight new railroad-shop tools brought out by Niles-Bement-Pond Company, of New York City.

Center-drive Wheel Lathe

In Figs. 1, 2 and 3 there is illustrated a heavy type of central-drive car-wheel lathe. It is considered by many that there are serious disadvantages in the method of driving the regular open-center type of lathe for car wheels and the center-drive machine is gotten up to overcome these objections.

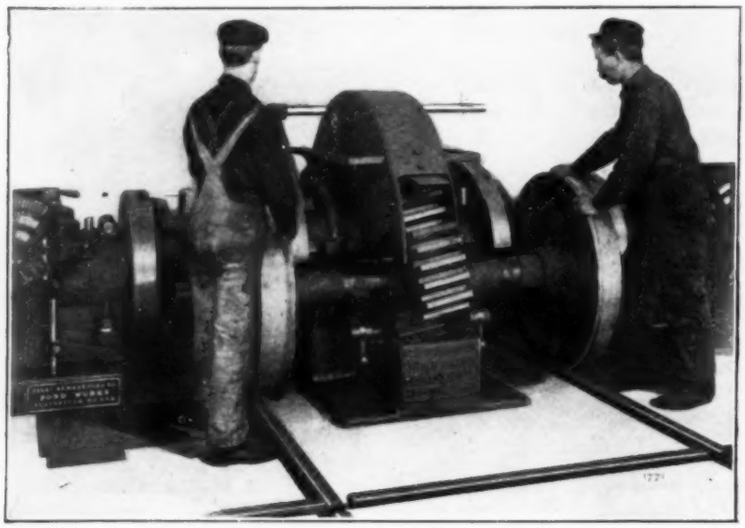


Fig. 1. Heavy Center-drive Wheel Lathe

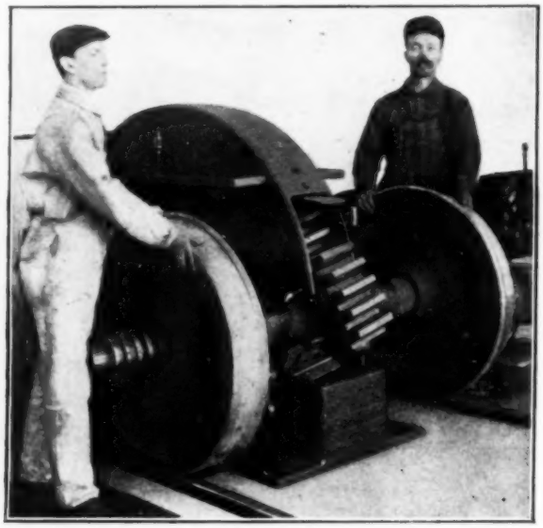


Fig. 2. Nearer View

In this particular machine all movements are manipulated by power, these including moving the heads along the bed, clamping the heads, raising the wheels into position, and clamping the tools. All of these operations are performed by pneumatic pressure. The segment in the central driving gear opens, closes and locks automatically as the wheels are rolled in and out.

With this machine it is asserted that three pairs of 42-inch wheels may be finished per hour, as an average day's run. Power is furnished by a 40-horsepower motor, which is supposed to give all the power that the best cutting tools will stand. In the central-drive arrangement the wheels are supported on both sides, the idea being, of course, to secure rigidity and absence of vibration.

Power Tool Clamp

Another feature of the lathe just described is that the tool is held by a power clamp, shown in Figs. 3 and 4. This will be appreciated when the very large tools used on these lathes are considered. This power tool clamp takes the form of a jaw operated by a pneumatic cylinder, which forces a wedge between rollers to cause the jaws to clamp the tool against the body of the tool fixture. The jaw, which is the upper member, is held by a suitable fulcrum, a heavy spring serving to support and open it when the pneumatic pressure is released.

By the wedge construction, it will be

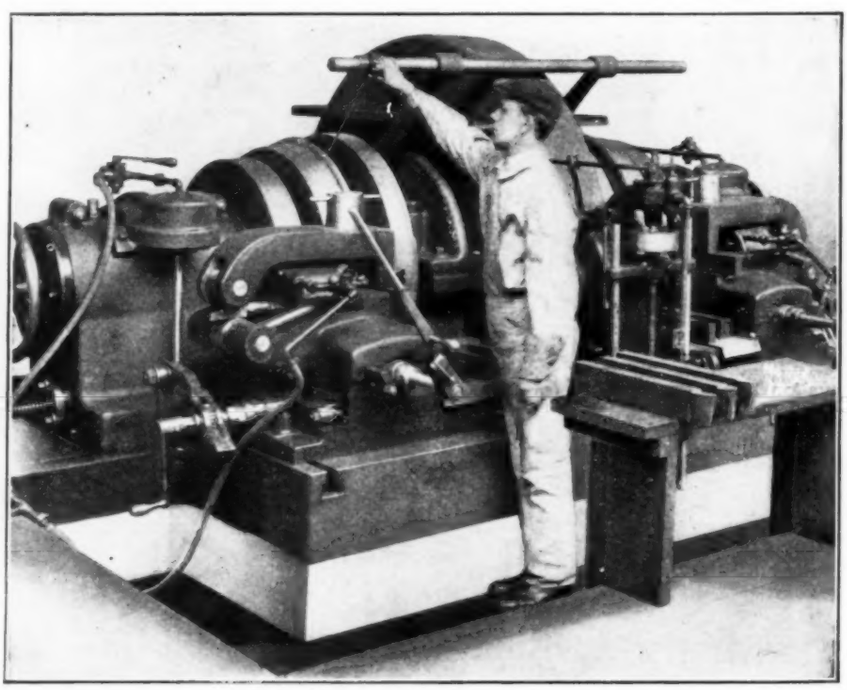


Fig. 3. Pneumatic Operated Tool Holders on Wheel Lathe

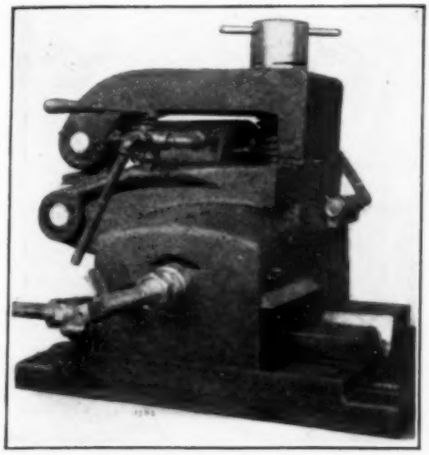


FIG. 4. PNEUMATICALLY OPERATED TOOL HOLDER

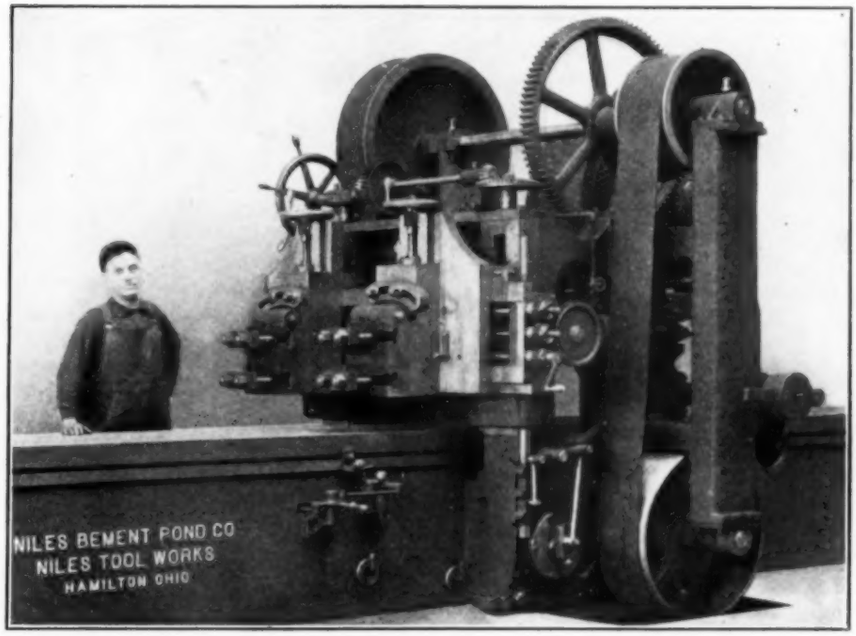


FIG. 5. FROG AND SWITCH PLANER WITHOUT SHIFTING BELTS

noted that the gripping power does not come directly upon the air in the cylinder, but upon the wedge itself. By putting the air cylinder down inside the parts, there is no interference with a direct view of the work and as the tool rest is entirely open at the side, it is a simple matter to change tools without moving the slide. It will also be seen that the tool slide is provided with a graduated scale.

FROG AND SWITCH PLANER

The feature of this planer, which is illustrated in Fig. 5, is that shifting belts are eliminated. There are two belts; one to drive the table on the cutting stroke and one to reverse, and they operate on their respective pulleys by means of idler tightening pulleys, which are carried on bell-crank levers controlled by pneumatic cylinders. By this arrangement first one belt and then the other is tightened to drive and then loosened, so that it is practically free from the pulley. In this way it becomes unnecessary to shift the belts and there should be considerable saving in belt expense.

As this planer is designed for planing frogs and switches, 12 inches head room is all that is allowed under the rail, and in this design, the rail is not attached to the housing by bolts but is furnished with a hand adjustment. Power is furnished by a 50-horsepower motor having a speed range of 1¼ to 1. This range is sufficient to allow for ordinary variation in quality of material to be machined. A constant-speed motor can be furnished if so desired. Table rack and all gears are of steel, cut from the solid, and all shaft bearings are lined with bronze. Driving gears are inside the bed and the table is furnished with vertical side bearings. Distance between housings, 42 inches; hight under cross rail, 12 inches.

HEAVY ROD MILLING MACHINE

The most striking feature of the heavy rod-milling machine shown in Fig. 6 is that there is no cross rail. The outboard bearing which supports the arbor, opposite the milling head, is located on the right-hand post. The machine is intended for surfacing and fluting two rods, side by side, at the highest speed of which high-speed milling cutters are capable. Drive is by direct-connected variable-speed motor. The table is 14 feet long and has a working surface of 42 inches

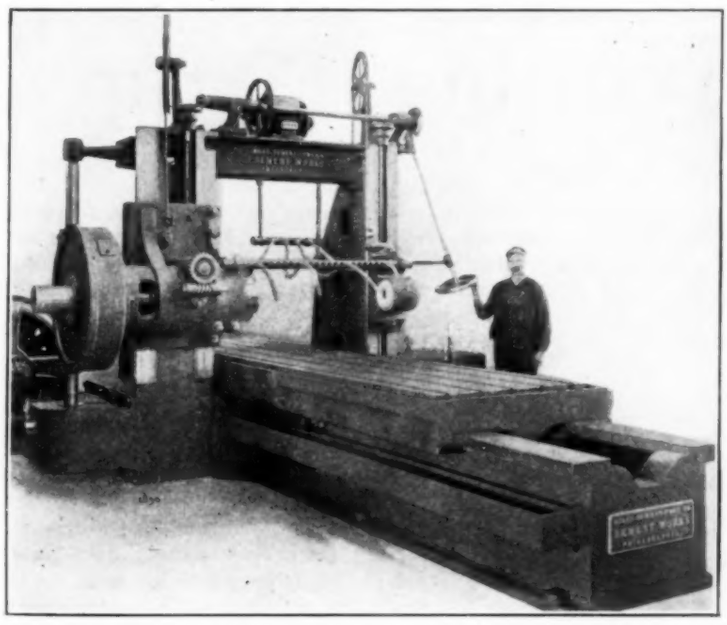


FIG 6. HEAVY MILLER FOR SIDE RODS

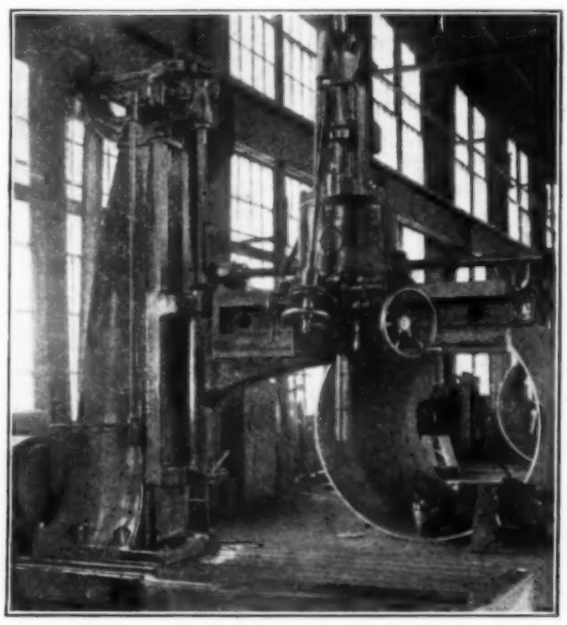


FIG. 7. LARGE RADIAL DRILL PRESS

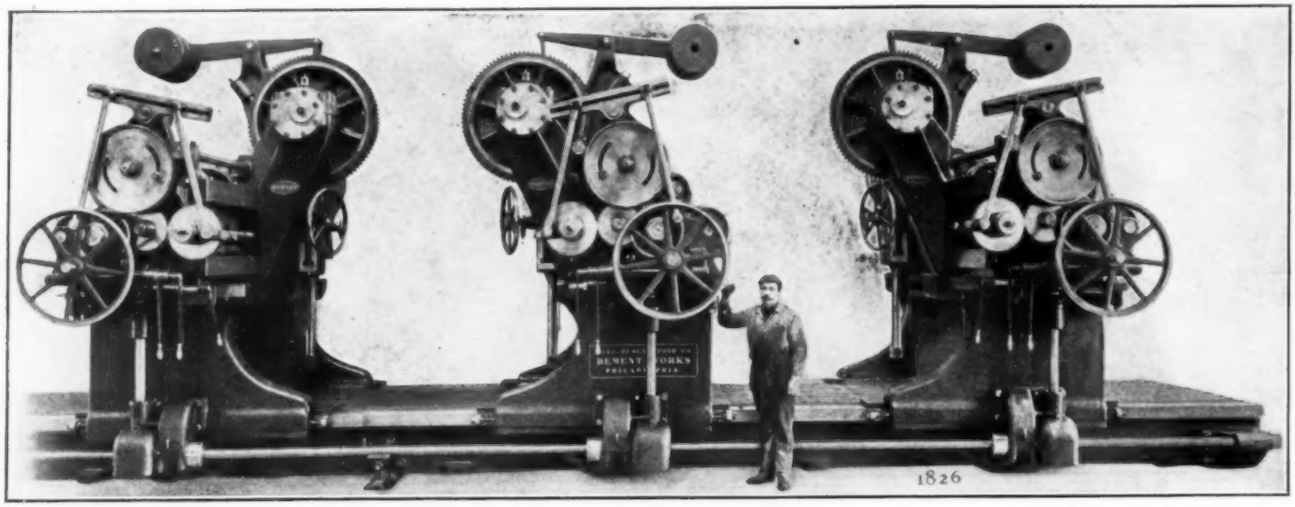


FIG. 8. HEAVY TRIPLE-HEAD SLOTTER FOR LOCOMOTIVE FRAMES

width. There is also a fine hand adjustment and a rapid power traverse for the table.

LARGE RADIAL DRILL

In Fig. 7 is illustrated one of several large radial drill presses built to meet the specifications of the American Locomotive Works. Part of these specifications was that the drill press should be capable of driving any drill to destruction.

All bearings are bronze lined and wherever possible are of the ring oiling type. Drive is by means of variable-speed motor mounted on base. The controller for starting, stopping, reversing and speed variation is mounted on the arm within reach of operator. In fact all operating handles are in front of the head.

Spindle is back-geared and counterbalanced and provided with reversing gears for tapping. Arm is mounted on a long slide in ball and roller bearings. Hand wheels control the spindle and saddle traverse and are so located that workman can operate either and swing the arm at the same time.

Plain box table or a box table with swiveling shelf can be furnished. This machine will drill to the center of a diameter of 13 feet 6 inches, the distance from face of column to center of spindle being; maximum 6 feet 9 inches, minimum 2 feet 9 inches. Greatest distance, base plate to spindle, 7 feet 4 inches.

TRIPLE HEAD FRAME SLOTTER

For slotting 5 or 6 locomotive frames simultaneously, the triple-head frame slotter illustrated in Fig. 8, has been brought out. The bed of this machine is 50 feet long by 85 inches wide, the opening under the yoke being 61 inches inside and 34 inches high. Each head is driven by a 20-horsepower motor. The maximum stroke of the cutter bars is 32 inches.

Friction clutches are employed for driving the cutter bars, so as to give convenient control. Rapid traverse clutches are provided, both for moving the cutter bar saddles along the cross rails, and for traversing the yokes along the bed. For these traverse movements nuts are provided which revolve on fixed lead screws, those for moving the yoke being on each side of the bed. The lead screws are supported near the center by a bearing which automatically drops out of the way when the head is passing over that portion of the lead screw.

Swivel is provided for the cross rails in either direction, sufficient for slotting the taper on the pedestals of the frames. The machine is built for the heaviest service.

Rivet- and Pin-cutting Fixtures

By John A. Rutter

A very practical and inexpensive rivet- and pin-cutting fixture is in use by us at the present time. It consists first of a block of steel *C*, Fig. 1, with a couple of holes drilled and counterbored in it, by which it may be screwed to the face plate of a lathe. There are also put in it two tools *A* secured by set screws so as to make it possible to vary the distance *X* which is the length of the rivet.

Fastened in the tool post of the lathe is the rest shown in Fig. 2. This is nothing more than a piece of machine steel with a hardened-steel bushing in it having the hole *B* a trifle larger than the wire from which the rivets or pins are cut.

The wire is put on a reel at the back of the lathe. The rest is now moved up until the tools *A* just clear. The wire is pushed through the hole *B* until it strikes the plate *C*. As the lathe head revolves there is plenty of time to force the wire against the plate and the tools revolving shear it off. A half-round groove in the tool the radius of the rivet makes a much cleaner cut.

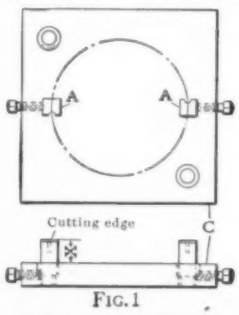


FIG. 1

FIXTURE FOR CUTTING OFF PINS AND RIVETS

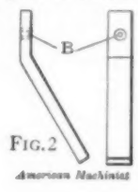


FIG. 2

American Machinist

We cut about 350 short rivets a minute with this fixture. For a longer rivet all that is necessary is to increase distance *X* and perhaps reduce the speed of the lathe.

An electrical patent, No. 960,823, entitled "Indicating and Measuring Device for Use in Mines or Wherever Desired to Detect Presence of Combustible Gases," by Harold H. Clark, Pittsburg, Penn., is dedicated to the public. Mr. Clark has spent time and energy in perfecting a device which he now freely permits all to use, and his example is well worth recording and following where the safeguarding of human life in industrial pursuits is the consideration.

Letters from Practical Men

A Graduating Fixture

We had to graduate 75 measuring arms, that were to be used on a specially constructed car to measure the clearance of tunnels. A railway shop is not equipped with graduating machines of any kind as a rule. However, the job had to be done in the tool shop, so I devised the fixture shown herewith.

The work is shown in Fig. 1. The clearance arcs *A* and *A'* were cut with the tool *B*, which consisted of a piece of machine steel of a suitable length, turned and one end tapered to fit the drill press. The other end was turned to ¾ inch diameter to fit the hole *b* in the measuring arm. A ⅜-inch hole was drilled and filed square in *B* for the bent scribing tool, which was made a good fit, and held by a set screw. This was all that was required to complete operation No. 1.

The next operation was rather more difficult on account of the graduations not being spaced an even number of degrees. Fortunately, we had a Brown & Sharpe vernier in the shop which, with a good pair of trammels, enabled us to get the chords as required on the print supplied to us. The base of our fixture was a steel plate, Fig. 2, which was easily obtained from the boiler shop. After straightening the plate and striking the arc *C*, Fig. 2, the chords were marked

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

off and a ½-inch hole drilled in every center to receive the locating pin *D*.

A hole was drilled and tapped to receive the center stud *E*, and guides were riveted on the plate to locate the slide *G*, which had a suitable V machined to receive the pointed end of the measuring arm, Fig. 1, the slots in the slide being made to clamp the arm while it was graduated.

A steel piece *F* was next machined all over and a slot 1 inch wide and 3¼ inches long was cut, in which the tool slide *M* was made a good fit. The pinion *f* worked out at 18 teeth 12 diametral pitch, and as it was not required to make a revolution, only 10 teeth were cut. The pinion was riveted to a handle about 9 inches long, which supplied all the leverage that was required. The tool *M*, ¼ inch diameter, was held by a 3/16 set screw fitted to the clapper as the sketch *M* clearly indicates.

Having the fixture ready, the operation of graduating was very simple and rapidly performed. The measuring arm *A*, Fig. 1, being placed on the stud *E*, was securely clamped by the slide *G*. The device *F* was also located by hole *e*, which slipped on the stud *E*, and the end *g* having the ½-inch hole which was made to suit the holes *h* in the plate *C* was held by the locating pin *D*.

The distance bush *H* was used to give tool *F* the correct hight, then with the slide *M*, operating lever, etc., we had a miniature shaper, and the 75 measuring arms were readily graduated from 24 to zero on each side of the center line as required.

WILLIAM WHITEHOUSE.

Montreal, Can.

Decreasing the Strength of a Spring

One would naturally suppose that when a tension spring had been stretched beyond its elastic limit so as to occasion permanent sets its usefulness was

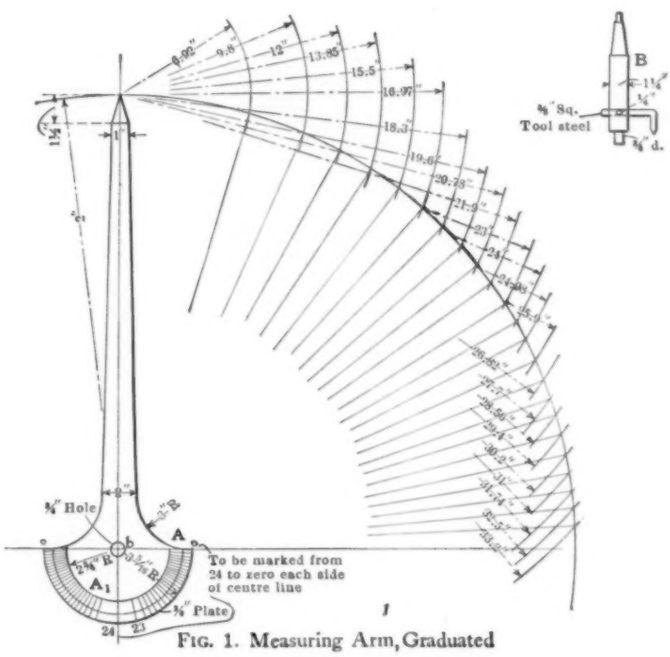


FIG. 1. Measuring Arm, Graduated

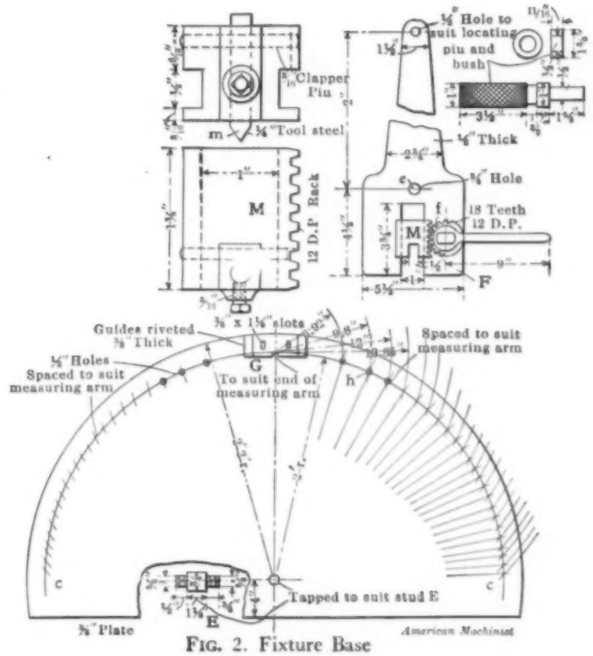


FIG. 2. Fixture Base

A GRADUATING FIXTURE

practically at an end. This, however, is not the case, and is well illustrated by the following experience:

A shipment of tension springs made of 3/8-inch wire 1½ inches inside diameter, 32 coils, through some error in the blueprints were wound too close and made shorter than specification. The tension, therefore, was about double what was required. The spring man when sent for loaded one of the offending springs, stretching it beyond its elastic limit until the proper length and the proper tension in the spring was reached. This spring was found to be just as good as others which had been properly made, and continued use has demonstrated that it sustained no injury whatever by this treatment.

The question was then to correct the balance of the springs, there being several hundred on the order. To do this quickly a hook-shaped tool was clamped in the vise of a 24-inch heavy shaper, another tool of the same shape was put in the tool post. The stroke of the shaper was then set until it would give the desired permanent set in the springs. These springs were remarkably uniform, very few of them breaking or developing weak spots. For those that did not stretch sufficiently the first time, the operation was repeated, giving the shaper a little more stroke. A comparatively short time was taken in this work, as the shaper was kept running constantly, the link at the end of spring being hooked on the tool at the beginning of each stroke.

New York. C. L. LOGUE.

A Sectional Jig Bushing

In jig work the toolmaker is occasionally confronted with a somewhat difficult proposition ensuing from proximity of bushing holes, or by holes exceptionally long relative to the diameter.

In such cases, the customary method of buttoning and boring is well nigh impossible, and where it can be applied, the undertaking is so precarious that more than one attempt is often necessary, resulting in spoiled pieces, and even if accomplished, the job is most unsatisfactory, due to lack of rigidity and position.

This difficulty can usually be overcome by substituting one large bushing built in sections, in place of small individual bushings. The method will permit of considerable modification to suit different requirements.

I give here a concrete explanatory case.

Required: Three bushed holes in line with each other and with centers 0.1 inch apart from the middle hole, to each of the outer holes, as shown in Fig. 1.

Outer bushing holes for No. 60 (0.4) drill, middle hole for No. 50 (0.7) drill.

In this case the closeness of the centers so limits the diameter of the hole to be bored that the difficulty of securing accuracy is apparent. To obviate this, use the position of the middle hole as a locating point, button and bore a hole large enough to take in the outer holes, plus a little for working purposes.

Fig. 2 gives a comprehensive view of the bushing with part serving as a cover along with three hardened pieces of rectangular section, containing the required holes. Fig. 2a shows the bushing in place.

The method of procedure is as follows:

Use a piece of cylindrical steel and turn up a bushing the size of the hole in the leaf (allowing for grinding) and partly sever at the head as in Fig. 3.

Grip the butt end of the stock and saw out the central portion to admit the rectangular sections, see Fig. 3a. This provides the two covers of the bushing.

Next secure a piece of plate steel, thick enough to allow for grinding and saw off suitable pieces for the inner sections. Locate approximately, and drill and ream the holes *a b c*, Fig. 4, to the required lapping sizes.

It will be convenient at this stage to drill small holes in the outer sections for riveting purposes, just clearing the long holes and countersink a little on one side, as shown at *d* in Fig. 4.

Note also that the outer sections should have a uniform width sufficient to cover the flange of the bushing, to facilitate the surface-grinding process, see Fig. 4a. These parts may be hardened, the holes lapped to size, and plugs inserted.

The grinding of such plane surfaces is obviously an easy matter. First grind one side parallel to the hole by clamping to an angle plate, and indicating from the inserted plug; then clamp the ground surface to the angle plate, indicate as before, and thus secure two sides parallel to the hole, and at right angles to each other. The parts may then be placed on an ordinary magnetic chuck and ground accurately to size. These points should be borne in mind, of course, distance from center to center of holes, and also from center of holes to the side of block, to be the same for each section. When finished, the blocks may be riveted to one of the covers, which should be ground on the flat face, as seen in Fig. 4a, care being taken to clamp the surfaces together while riveting. This will insure the retention of their proper relation to each other.

It will be noticed that the middle bushing is unsupported. This is remedied by soldering the remaining cover to all three surfaces. The bushing is then compact and rigid, and the cylindrical surface can be ground on an arbor in a bench lathe, using the middle hole as a pivot. If the hole is very small, it may be countersunk a little at the bottom and supported by the tail center.

In fixing in the jig leaf, it will be found necessary to have some means of bringing the holes in line with each other. This

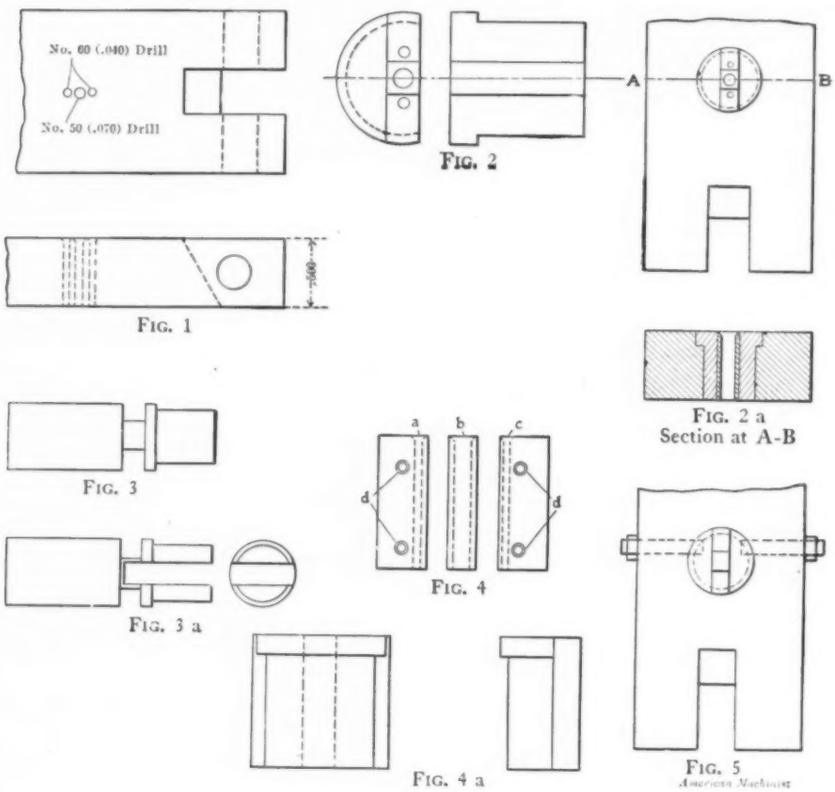


FIG. 1

FIG. 2

FIG. 2 a
Section at A-B

FIG. 3

FIG. 3 a

FIG. 4

FIG. 4 a

FIG. 5
American Machinist

A SECTIONAL BUSHING

impediment can be overcome by making the bushing a sliding fit and adjusting by means of small screws with locknuts, as shown in Fig. 5.

A little thought will show that the principle admits of limitless variations, insures a permanent and rigid job, and makes possible a degree of precision altogether unattainable by other methods.

Middletown, Conn. ELI ALLISON.

Press Tools for Making Special Washers

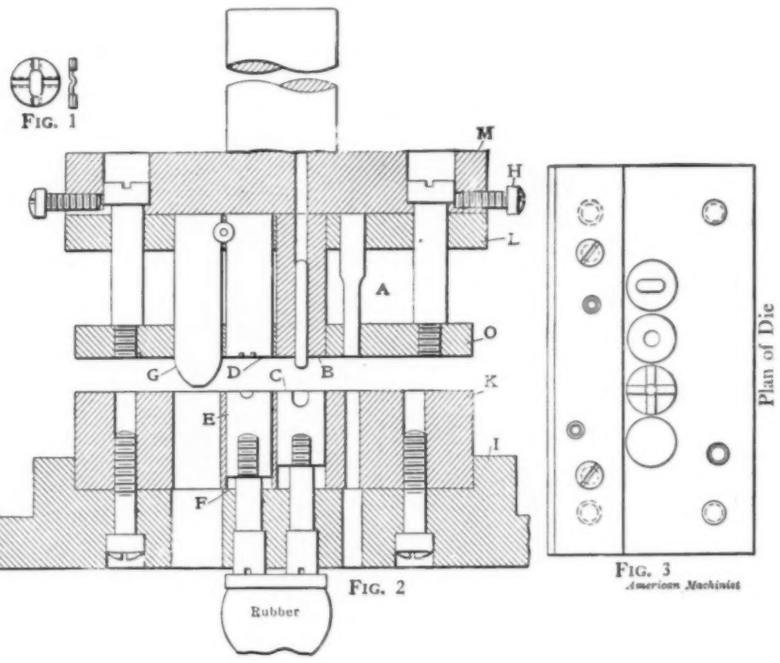
The sketches illustrate a special washer and the tools which were made to produce it with as little handling as possible. The washer is shown in Fig. 1, and the tools in Figs. 2 and 3.

The die is made in the usual manner, except that all the operations are performed continuously in one die. *K* is the die in which the punches are fitted. *A* is the first piercing punch, *B* is the blanking punch, and *C* is the pressure pad. After the two operations, the blank is forced back into the strip by means of pressure pad *C*, actuated by rubber, and then moved along to the forming punch *D*. After the forming it is pressed into the strip and moved up to the knockout *G*. *E* is the lower former. Usually in compound dies, the work has to be removed or taken out from the strips, but in this case the punch *G* is arranged to do this, and at the same time, it acts as a guide to locate the strip. *O* is the stripper, held by four screws. When setting the die, the stripper is held up by screws *H*. The stripper is actuated by spring, not shown. *E* and *C* are actuated by rubber and held with screws, not shown. *I* is the die shoe, made of machinery steel. *L* is a machinery-steel punch plate fastened by screws to punch holder *M*.

Fig. 3 is the plan view of the die. The gage to guide the stock is shown at *N*. The stock used is 1/32 cold-rolled steel. The die does not require a stop pin, on account of having the knockout ½ inch longer than the punches *A*, *B* and *D*, and this locates the stock correctly.

A die of this construction is very satisfactory and can be used on similar work without handling the blanks a second time.

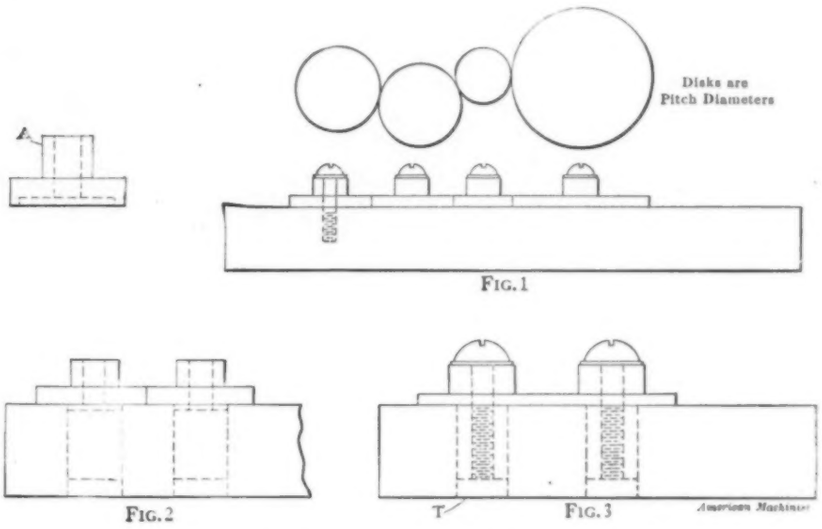
Freeport, Ill. CHAS. EISLER.



PRESS TOOLS FOR MAKING SPECIAL WASHERS

Disks for Locating Holes in Master Plates

When making master plates or jigs that demand extreme accuracy, the following method will be found much easier and possibly more accurate than the button method, which in most cases necessitates the use of a hight gage in locating the buttons.



DISKS FOR LOCATING HOLES IN MASTER PLATES

The disks, Fig. 1, are made with a pilot *A* turned at the same setting as the disk proper to insure concentricity. This pilot is simply to provide a good contact surface for the indicator, and if there are several holes in the jig that are close together, it will be found advantageous to make the pilots of slightly different lengths. By indicating the longest one first, then drilling and boring, there is no interference when indicating the next longest one and so on. By making the hole in the disk absolutely true with the outside by boring it before cutting off the disk, an excellent means is afforded of testing the truth of the jig after it is hard by turning a plug to fit the hole in the jig and having a teat on the plug that fits the hole in the disk as in Fig. 2.

I have found it good practice to drill the holes in the master plate or jig to within, say, 1/16 of finish size, then, as in Fig 3, insert soft plugs sufficiently tight to permit of securely fastening the disk; the object being to eliminate as far as possible the distortion due to drilling a number of holes in the jig or master plate. It is a fact that no matter how nicely the block of steel or cast iron for the master plate is aged, it will change a trifle when a number of holes are made in the block. Therefore, by carefully drilling the holes reasonably close as to relation to each other, and setting the disks by means of plugs, the holes in which

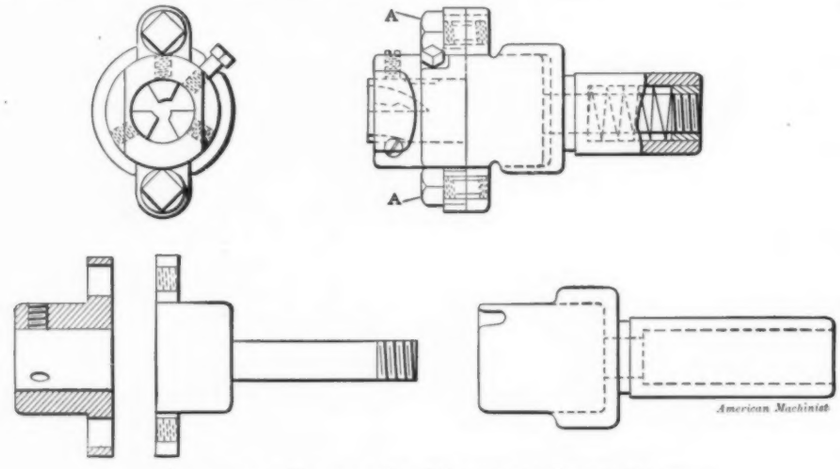
are tapped, it requires but little boring to finish the plate.

At one time I worked in a factory where the master plate or jig plate was carefully laid out with buttons, drilled and bored to within a few hundredths, then the block was permanently "set" or aged by constantly expanding and contracting it for possibly one or more hours. The method in vogue in this particular shop was to hold the plate in hot liquid (water will answer) until it assumed the same temperature as the liquid, then quickly immerse the plate in ice water to suddenly contract it. The value of this practice can be tested by machining, say, a punch to within 1/16 inch of finish size, then heat it red hot and allow it to cool. This will remove internal strain and the punch will not change as much when hardened as if it were finished to exact size with a slight internal strain. Many will blame the hardening process when the trouble really lies in not removing strain before finishing to size.

Lansing, Mich. A. R. FOWLER.

Adjustable Tap and Die Holder for Automatic Screw Machine

The drawing shows a holder for taps and dies which can be adjusted until the tool lines up with the center of the spindle, when the holder is clamped with screws at *A*.



ADJUSTABLE TAP AND DIE HOLDER FOR SCREW MACHINE

Adjustable holders are used a great deal for reamers, etc., and as the threading tools give more trouble than any other tool, their holders can advantageously be provided with adjustment.

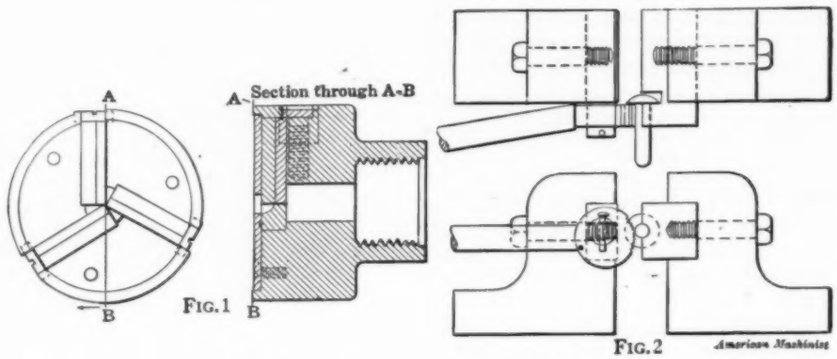
This holder does not take up any more room than the ordinary tap and die holder, and a collar is not needed, as will be seen by referring to the drawing. The spring for withdrawing the die (after the spindle has been reversed) is contained in the shank as represented.

Cleveland, O. S. H. BACON.

Tools for Rounding Points of Button Head Pins

Having a batch of 100,000 button-head pins to form to a nicely rounded point it was necessary to devise some quick way for doing the work. Our chamfering machine is a home product, being made from the bed of a single-head threading machine fitted with a sliding head operated by a foot treadle and driven by a cone pulley. The head, as is seen by Fig. 1, is fitted with formed cutters, which can be ground on the end and adjusted to position by the fillister-head screws shown.

To make the cutters we saw them to length from a bar of 5/8 square Novo steel, put them in the slots in the head, fasten on the steel plate (shown in section 1) by means of three 5/16 counter-sunk screws, put a piece of 1/2 round tool steel, which has been turned and fluted to the shape of the point of the finished pin, in the drill press and drill down in the blank cutters the depth required. Then we take out the cutters and shape them down their full length to the shape formed by the drill.



TOOLS FOR ROUNDING ENDS OF PINS

The vise is of the ordinary threading-machine pattern and is bolted to the bed, but can, of course, be shifted to various positions to accommodate different lengths of stock. The vise is fitted with cast-steel jaws, as shown by Fig. 2. The eccentric gripping lever is made from 5/8 round tool steel and fluted similar to a pipe wrench. Any turning of the pin serves to increase the grip of the lever. This method has proved such a success that the principle is being applied to several other jobs of a similar nature.

HERBERT E. CHITTENDEN.

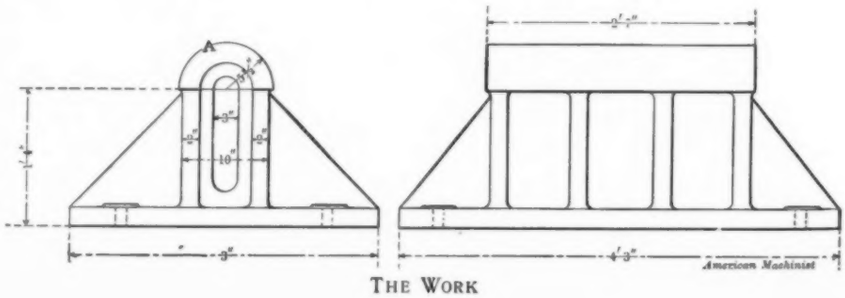
Brantford, Canada.

How Would You Machine These Pieces on a Planer?

Having quite a number of cast-iron knuckles which are used on bridge bearings, to machine on the arc *A* which has a radius of 5 1/2 as shown, I should like to have the opinion of some of the readers of the AMERICAN MACHINIST as to how they would do them on a planing machine.

Newcastle, England. TYNESIDER.

["Quite a number" is rather vague but if we had the job, had to do it on a planer, and there were sufficient pieces we would make a circular cutter and rig up to mill them.—ED.]



THE WORK

Discussion of Previous Question

Loose Pulley Bushings and Other Things

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

In looking over a recent issue of the AMERICAN MACHINIST I was at once attracted by the article on bushing loose pulleys by Paul Campbell, because, being at one time repair man at our plant, I know a good deal about the trouble with loose pulleys. A hint from a friend put me on the right track in the loose-pulley business, for all time, as we have loose pulleys now running and in good shape that have been in constant use for two and three years.

Instead of using the flange bushing, as Mr. Campbell does, we just turn a straight bushing in one piece and a nice running fit in the pulley. This is perforated with

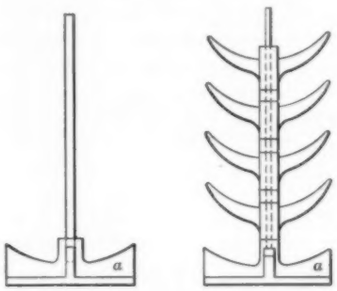


FIG. 1. RACK FOR COLD-ROLLED STEEL OR IRON

from fifty to seventy 3/16-inch holes, according to the size of the bushing; then an oil groove is chipped nearly the whole length of the pulley, so the oil will flow from one end to the other on the loose bushing. The oil pipe with plug in end is the same as Mr. Campbell's, in the center of the pulley. If that oil pipe is filled once a week and your countershaft doesn't fall down the pulley will run indefinitely, without trouble.

Here is something else. Some few months ago I noticed a new rack for different sizes of steel and iron, to be handy for use near the bar machines. While that was a good rack I think ours is a little nicer. It is made in sections as in the sketch, Fig. 1. The base *a* is a four-cornered affair that can be fastened to the floor, but will stand without fastening just the same. This base is cored (in the foundry to save boring) to receive a 2½-inch shaft, or any other size you might want. Then the steer's-horn sections are dropped on, these being also cored out to fit the cold-rolled steel post. We made a large number of 4-inch collars to put between the sections, to make them any distance apart as desired. There is no machine work whatever on this rack and it costs very little, but is strong and durable. It is impossible to load this rack down so it will break. I've tried it.

Here is something else. We make thousands of collars in the course of a year, at our place, and one of the boys

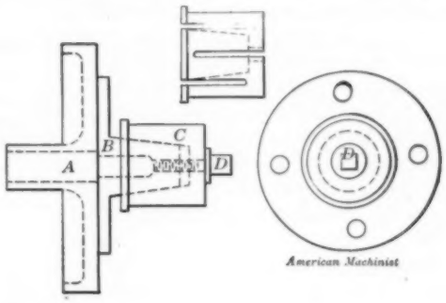


FIG. 2. COLLAR TURNING CHUCK

who became tired of driving a mandrel in and out, as in the old way of turning off collars, thought he could devise a way whereby the driving business would be eliminated; and he did. I submit a sketch, Fig. 2, of this device. *A* is the lathe face plate. *B* is a plate fastened to the lathe face plate, with a taper turned on it to receive the split bushing *C*. The bushing *C* is split three times at each end, so it will expand very easily. You slip the collar to be turned, on bushing *C*, tighten the screw *D* and then you are ready for any kind of a cut. Of course, we have different size bushings for the collars are of several sizes.

By boring out these collars and facing them on one side, on a turret lathe, we can turn out a lot of work in a day. Of course, the bushings are made a little shorter than the collars so a cut can be taken off the end; it is then possible to turn and file and polish, without any inconvenience whatever. You loosen the screw, tap the collar and it is loose to slip off easily.

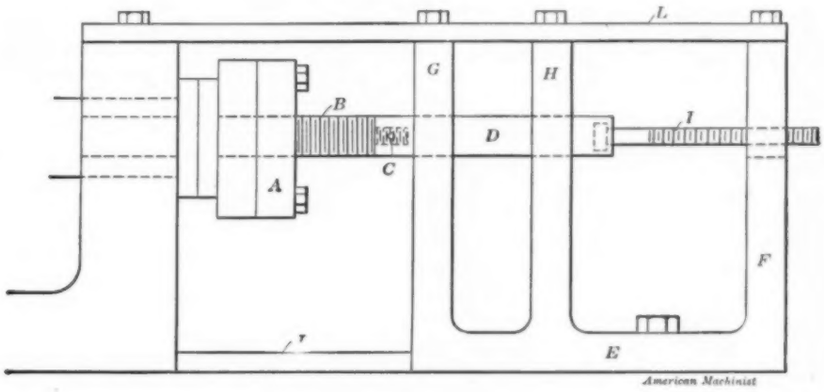
Salem, Ohio. ARTHUR HARWOOD.

A Broaching Attachment for Lathe

D. Foster Hall's article on page 1027 reminds me of an attachment I made for the same purpose about 15 years ago and applied to an old lathe.

The objection to the device shown on page 1027 is that the pull on the broach is not in line with the pull on the screw. In the attachment which I made, this objection was not present.

The nut *A* was bolted to a small face-plate. The screw *B* was threaded at *C* and screwed and pinned into the square cold-rolled piece *D*. The casting *E* was planed flat on the bottom and bolted to



A BBOACHING ATTACHMENT

the lathe bed. The face *F* was planed square with the bottom to make a seat for the work. A milling cutter was run through the three uprights *G*, *H* and *F* at the proper depth to make bearings for the square cold-rolled sliding shaft *D*. The end of *D* has a T-slot cutter run in at right angles to hold the end of the broach *I*. A piece of boiler plate *J* was laid on the bed between the casting *E* and the lathe head to make the pull of the nut *A* and the piece *L* was used to bind *G*, *H* and *F* together.

This made a very rigid broaching attachment which could be put in place or dismantled in ten minutes.

New York. E. M. BAIN.

Following Rules vs. Accepting Responsibility

I fully agree with Mr. Taylor when he says in his article on belting, page 766, "Further than intelligent judgment, no fixed rule can be employed owing to the different conditions under which belts of the same size work."

Inasmuch as all of his article except these few words is devoted to doing away with judgment of any kind I stop my approval at that point.

What Mr. Taylor is proposing is simply to do away with our intelligent skilled mechanics. He is trying to do it by substituting for intelligent effort, machine-made effort. Intelligent effort comes only from practice; if the practice is forbidden the result is sure to be that intelligence will be lacking in the emergencies where it is most needed. The men who are worth the most are men who can rise to emergencies, and the men who can rise are men who have met small emergencies repeatedly.

VALUE OF OVERCOMING DIFFICULTIES

A man who intends to run a Marathon race does not spend the year beforehand talking about it; he goes out and runs a mile, then more miles and more miles until he gets where he can run the distance without injury to himself. The man who wants to accomplish things around the shop does not want to have a book of rules to go by; he wants to be left alone with the job and put his native ingenuity to test.

I remember my father took me driving on Sundays, when I was a small boy, through all the beautiful roads about this section of the country. I drove. That is, I held the reins. When he thought we ought to go to the left he told me so. We went to the left. He never mentioned where we were going nor how we were to get there. We just drove. When later I wanted to take my family to drive over these same roads, I had to buy a road map and study it out. I got some good out of that, but to this day there is one particular bridge of which I have a sketch, which I wish to see again on account of the peculiarity of the bracing; but I cannot find it! It is within 10 to 15 miles and I have been looking for it for 10 years.

That is just where any man will land if he goes hunting experience with a book of rules. I also believe that the employer that tries to run his shop on rules will reap what he sows. It has been my experience that men who are given something to do and gently steered in the direction they should go and not dictated to, rise to the occasion and ultimately make splendid men, unless they are worthless, in which case you find it out quickly.

ACCEPTING RESPONSIBILITY

The average man has pride and a lot of it. To be sure he has had to smother it for years, but give him a job to do on his own responsibility and all that latent pride comes to the surface, and from that moment he is working for you and with you to get the job done. The man at the top who seeks to get there by having inferior subordinates who will submit to be governed by a book of rules, is sure to land at the bottom. A man can only stay up by recognizing that the men beneath him are buoying him up; he has nothing above by which to pull himself up. If he flatters himself that he has he will one day find himself dropping back to be trampled by the very men by whose abilities he refused to profit.

Springfield, Mass. ENTROPY.

Universal Joint Angular Variation

The article on Universal Joint Angular Variations, by E. J. Stoddard, page 503, was interesting to me and the first explanation of this problem it has been my fortune to see in print.

To this may be added that this irregularity of motion may be overcome when two joints are used as a pair, by setting the yokes as shown by Fig. 1, the inner yokes being in line, or in the same plane with each other.

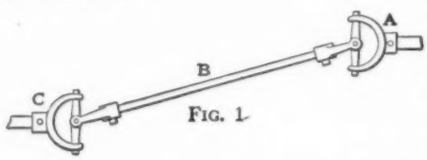


FIG. 1.

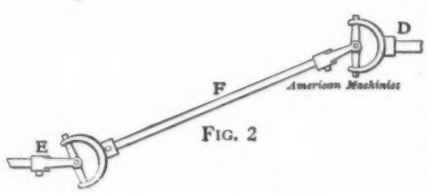


FIG. 2.

UNIVERSAL JOINT POSITIONS

With this arrangement, driver *A* and driven member *C*, would move at a uniform rate, while the connection *B* would move at an irregular rate, but the variations of one joint will correct or overcome the variations of the other joint.

To get the full benefit of arrangement No. 1 it is evident that the shafts *A* and *C* should remain parallel with each other without regard to whether they are in line with each other, or not.

When the yokes are set as shown by Fig. 2, with the inner yokes at right angles to each other, the variations are doubled and this arrangement should be avoided, for whatever purpose the joints may be used.

It will be noticed that in Fig. 1 the rings are parallel with each other and on trial it will be found that at any angle the rings will keep parallel throughout the revolution. With arrangement as in Fig. 2, the rings will be continually changing the angle at which one stands with reference to the other, as the joints revolve.

Plymouth, Conn. A. M. GORDON.

Extracting Small Slivers

Since reading Mr. Hobart's article on page 796, and Mr. Dixie's article on page 979, on the above subject, I have concluded that perhaps the method that I sometimes employ in locating these small, and to the naked eye invisible, slivers might be of use to readers of the AMERICAN MACHINIST. If you will hold your finger up in bright sunlight and bring the edge of a pocket knife down against it you will observe that by looking toward the light the flesh is quite transparent underneath the knife blade for a depth of about one sixteenth of an inch. The bright light of the sun combined with the reflection of the light from the knife blade seems to produce a sort of an X-ray effect. Thus when that portion of the hand with one of these little tormentors is held up to the light and a knife blade slowly scraped across it, attempting in the meantime to look between the knife blade and the finger, the offender can nearly always be located, after which it can be removed with the aid of a glass.

The folding glass described by Dixie is certainly all right, but I recently came across one in the possession of a fellow mechanic that I like better, probably because I have difficulty in holding an ordinary glass in my eye. This glass was a homemade affair, and consisted of an ordinary spectacle frame from which one of the screws holding the bow in place had been removed and one long enough to reach through a hole drilled through the flattened end of a piece of 1/16 rod, and the frame, put in its place, thus making it possible to have the short piece of rod fixed to the frame in a position so that it would stand straight out when the frame was adjusted in position. From a common brass-mounted folding glass the glass together with its binding had been removed by filing off the rivet and driving it out, then a small hole was drilled at right angles to, and entering the hole on which the glass had swung in its frame. This hole was tapped and provided with a small nurled-head set screw. This made it possible to slip the glass on the rod and adjust it in any required position before the eye, making a very convenient, comfortable glass to use.

Albany, N. Y. T. COVEY.

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American Machinist

Editorial

The Government Should Do Its Part in the Training of Workmen

A number of the largest manufacturing concerns have established excellent apprentice systems, by means of which the best instruction is given to the apprentices, and high-class, all-around mechanics are produced. This educational work is, of course, primarily for the benefit of the concern giving the instruction, as it produces a class of excellent mechanics thoroughly familiar with the methods of the establishment and also its product. It is also from this class of mechanics that the best foremen are obtained. The benefits, however, are not confined to the establishment that spent time and money training these men, as some go to other establishments, and the whole industrial community is benefited.

It is only just and right that each should do his part in the training of workmen for the common good. The education of trained workmen is of great benefit to the country as a whole, and under these conditions it would be expected that the National Government would take the lead in establishing good apprentice systems in Government shops. This, however, is not the case. It is true that there are apprentices in the Government shops, but little or no effort is made to educate and train the boys, and the system of instruction in many commercial establishments, when compared with the Government methods, should shame the responsible officers of the Government.

While there are some exceptions, it is generally true that under present conditions a certificate of apprenticeship from the Government is little recommendation in the commercial industrial world.

The Government operates a number of large industrial establishments in various parts of the country. These are the navy yards and the naval gun factory under the navy department, and the arsenals, under the war department. In these establishments there exists an excellent field for training workmen, as many skilled trades are employed, and there is much repair work and some new work.

The Government should lead in this important educational work, and the very best system of training should be established in every Government shop. We urge that the navy department and war department at least do as much as is being done by well conducted commercial establishments in this important work.

Place Responsibility on Engineering Undergraduates

The *Old Farmer's Almanac* might well say, "About this time look for a heavy crop of engineering graduates," for we have some thousands to assimilate. How easily they will become a part of the engineering world and take up responsible work depends so largely on the attitude of the men in whose hands they have been, that a word to them may be more to the point than all the excellent advice that has been showered on the graduates themselves.

The education of these young men has been proceeding along more or less logical lines, step by step, for some 16 years, of which the last four have been under the direct control of the engineering schools. During the other 12 these boys have been taught many valuable things, but they have also been taught, by each other, to crib, cheat, plagiarize and loaf. These things, to the semi-civilized mind of the high-school graduate, are laudable if not found out by the school authorities. In dealing with the outside world these boys are most generally honorable and possessed of a very different standard of behavior.

The causes which lead to these defects in students are due in the main to the wholesale way in which their training has progressed, and to the impossibility of meting out punishment to the proper parties at the proper time, due to the natural boy prejudice against tale-bearing. The boy who is unjustly punished is a martyr and becomes a hero. The boy who gets off without deserved punishment is a greater hero.

The problem that confronts the technical professor is, in four years to neutralize the effect of the previous twelve. It is his problem to take his boys as he finds them and turn them in that brief space of time into loyal, honorable, thinking men, capable of assuming responsibility. To our minds this is a serious problem and one not capable of solution in any dogmatic way, but one to which many minds must turn before the technical graduate can take the place in en-

gineering circles for which he is in other respects fitted.

One thing that might help would be a gradual but distinct placing of responsibility upon students. This is done in a half-hearted way in most institutions, but with little more in the way of results than usually follows any half-hearted reform.

Boys, by the time they reach the junior and senior years in college, are of age and legally responsible. If they are not it is perfectly feasible to make such a contract with their guardians that they can be as surely compelled to do work assigned them as if they were working on a salary, and also a contract such that they be entrusted with expensive apparatus and machinery and held responsible for any damage that they may do to it through carelessness.

Just so long as a boy has to call upon an instructor to see that his setting up of a certain machine is correct before he goes ahead to run it, he is unfit to enter upon the commercial use of that machine or to direct others in its use. If his instructor can turn him loose with the machine, after having given him the necessary preliminary instructions, with the assurance that the boy has a sufficient money interest in its successful operation to guarantee care, then he can go about other things with confidence. If the boy has this money interest in its successful operation, then he will use the precautions common to men of being sure that he is right before he goes ahead. Curtain lectures have become so common a part of his previous school experience as to be simply tiresome to him, but money talks to him just as loudly as it does to the rest of us.

The Strides of Machinery

The daily press has just announced the celebration of the eightieth birthday of Elizabeth M. Kilbourn, of Winsted, Conn. Miss Kilbourn is the first woman who ever operated a sewing machine.

She was a school teacher in New Hartford, Conn., and a friend of Howe, the inventor of the sewing machine. One day Howe placed her in front of the first machine that he had built, and when she had operated the machine and it had made a few stitches, he told her that she was the first woman to run a sewing machine.

What a commentary this is on the rapidity of the development of machinery. Within the lifetime of Miss Kilbourn—and also of many other persons still living—the sewing machine has been conceived, perfected and distributed over the entire world.

Yet, if we turn to some other fields, as the electrical, the strides of development have been even longer and more rapid. It is only a very few years ago that the world saw the beginning of the application of electricity to human needs.

All of these developments have been brought about by the work of the inventor, the machinist and the engineer. To these men in the largest measure the world owes the present comforts of human life.

New Publications

Automobile Engineer, published monthly at 20 Tudor street, E. C., London, England.

The Automobile Engineer is the name of a new monthly publication which makes its bow with the issue of June, 1910. As the name implies, it is to be devoted to the theory and practice of automobile building from the engineering standpoint. This also includes the motors for aëroplanes, and, judging from the material presented in the first issue, it should prove both interesting and valuable to those engaged in this line of work.

Corrosion and Preservation of Iron and Steel. By A. S. Cushman and H. A. Gardner. Cloth, 375 6x9-inch pages, containing 68 illustrations. McGraw-Hill Book Company, New York. Price $4.

The corrosion of iron and steel and the methods employed or materials used to prevent this corrosion or rusting, have recently awakened a great deal of thought that has started numerous experiments and investigations on this line. This book deals with this subject more thoroughly than any that have come to our notice recently. It goes very thoroughly into the causes of corrosion and accepts the electrolytic theory as the most plausible one. The acid theory of corrosion is treated of in some length, and the book shows how this theory is in harmony with the electrolytic one. The book is certainly uptodate, as all of the latest investigations up to the time of going to press have been given and commented on. The probable impossibility of ever entirely overcoming the corrosion of metals containing iron is recognized and the corrosive properties of the different grades of iron and steel are shown.

The things that stimulate corrosion, such as certain paint films, wounds on the metal, mill scale, etc., are pretty thoroughly analyzed and their actions noted.

The various methods that are used to prevent corrosion occupy a large part of the book, and much valuable information is given. It deals with the various metal coatings, such as zinc, tin, copper, lead, etc., and also with the various kinds of paint, varnishes, lacquers, etc., that are used. The effect of the various pigments that are used in paint are thoroughly analyzed as to their corrosive or non-corrosive properties and the chemical properties of these, as well as the various oils, spirits, turpentine, dryers, etc., are given.

Personals*

W. C. Meissner has been appointed advertising manager of the Niles-Bement-Pond Company, succeeding H. M. Cleaver.

Allen Ransom, vice-president of the Marshall-Huschart Machinery Company, Chicago, Ill., has resigned his position in order to take a long rest to regain his health.

H. M. Cleaver, who has long been the advertising manager of the Niles-Bement-Pond Company, has been appointed manager of the foreign sales department of the same company.

W. E. Crist, president and general manager of the Crist Valve Manufacturing Company, is now the general manager of the valve department of the O. M. Edwards Company, Syracuse, N. Y.

George C. Olmsted, until recently connected with the Casey-Hedges Company, Chattanooga, Tenn., has become assistant master mechanic of the Crystal Falls Iron Mining Company, Crystal Falls, Mich.

C. V. Raper, formerly assistant works manager of the Société Anonyme Westinghouse, Le Havre, has been appointed general manager of the American branch of Darwin & Milner's tool-steel business.

Leopold d'E. Lenfestey, of the English Royal Artillery, and assistant superintendent of the rifle factory at Ishapore, Bengal, India, is at present in this country on a tour of inspection of shop-manufacturing methods.

Thomas H. Mirkil, Jr., general manager of the Southwark Foundry and Machine Company, Philadelphia, Penn., resigns his position in order to act in a similar capacity with the Poole Engineering and Machine Company, Baltimore, Md.

Lucuis I. Wightman, for the past six years advertising manager for the Ingersoll-Rand Company, New York, has resigned his position, the resignation taking effect August 1. He will open an office in New York City as an independent specialist in machinery advertising, handling the accounts of manufacturers of machinery and engineering products.

Charles A. Francis, who has been in Japan for the past seven years, engaging in several lines of mechanical work, sailed for the United States on May 31. Mr. Francis conducted an industrial-engineering practice in Tokyo and three and a half years was instructor of practical mechanics, department of mechanical engineering of the Tokyo Koto Kogyo Gakka (Higher Technological School of Tokyo). Mr. Francis was one of the Japanese correspondents of the American Machinist during his stay there.

*Items for this column are solicited.

New Tools and Shop Appliances

Fixed Focus Pyrometer

The halftone shows an instrument known as the Foster Fixed Focus Pyrometer, made by the Taylor Instrument companies, Rochester, N. Y.

With this pyrometer the user has absolutely nothing to do but to point the receiving tube at the furnace or other hot body whose temperature is to be measured. There is no focusing of the tube, no leveling or unclamping of the indicator; in fact, the instrument is always ready for immediate use. It is further very rapid in action, a steady reading being obtained in about 15 seconds.

The use of the instrument is shown in the illustration. Here it is being used to measure the temperature in a case-hardening furnace before withdrawing the boxes. The receiving tube is pointed at the hot body and the only rule that must be obeyed as to working distance is that the pyrometer must be used within a distance equal to 10 times the diameter of the hot body or opening. It does not affect the reading, however much the pyrometer is inside this distance limit, so

FIXED FOCUS PYROMETER

that no accurate measurement or judgment of distance is called for. The receiving tube being pointed at the furnace, the temperature is shown immediately by the pointer of the indicator moving over a dial giving a direct reading in temperature. The connection is made between the receiving tube and the indicator by means of the flexible cable. The indicator itself is a dead-beat double-pivot moving coil instrument. It does not require accurate leveling in use. In fact, as shown in the illustration it can be held on the hand to take readings. The pyrometer is, therefore, very convenient for the rapid checking up and exploring of temperatures over a battery of furnaces.

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

Rivett Internal Grinder

The accompanying engravings illustrate the No. 6 internal grinder made by the Rivett Lathe Manufacturing Company, Boston, Mass.

The machine is well shown by Fig. 1 and it will be seen from this engraving that a speed box is provided at the side of the column, from which six changes are derived for the table traverse. The countershaft gives six speed rates for the driving pulley of the gear box, and the table thus has 36 speed changes. The countershaft gives three changes for the smallest internal grinding.

The rated capacity of the machine is three inches, by six-inch stroke. The table is reciprocated by mechanism that assures a positive point of reversal, so that the wheel may be run to a shoulder with accuracy. The table is connected with the reciprocating slide by a device controlled through the medium of a small handle shown at the front of the table. This handle is readily operated to release the table and connect it again at any desired point in the travel of the re-

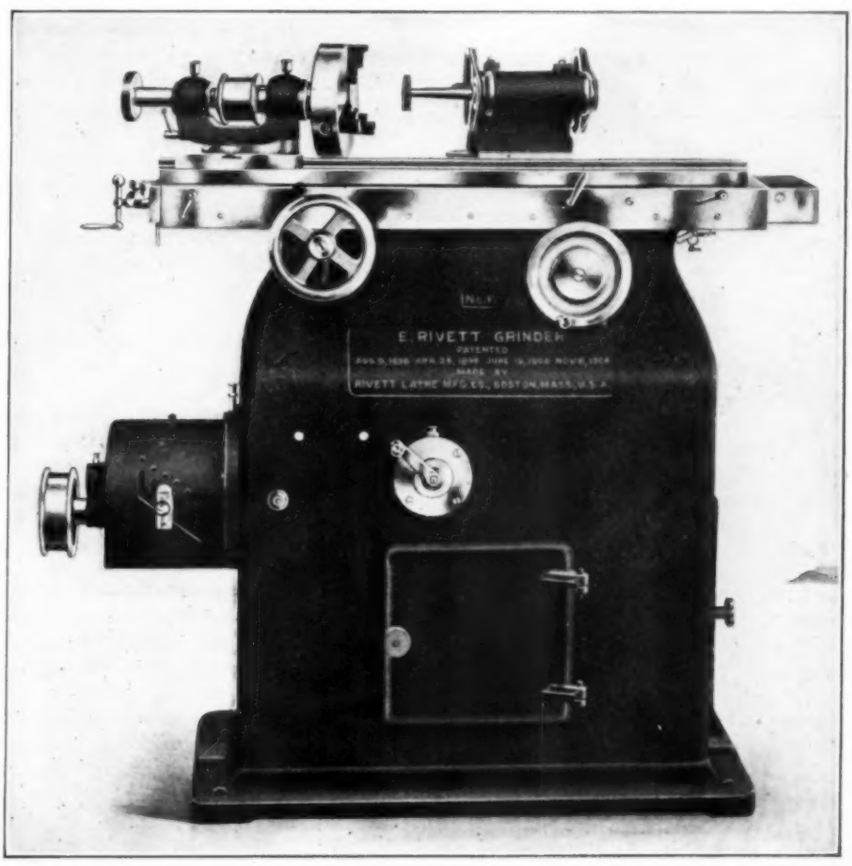


FIG. 1. RIVETT NO. 6 INTERNAL GRINDER

ciprocating slide. When released by this handle, the table may be operated by the handwheel to the left.

Another feature of interest in connection with the table operation is the adjustable positive locating stop controlled by the crank handle at the left-hand end of the table. When this has been adjusted, if it is desired to move the table by hand, say in working up to a special shoulder, a device at the left of the table is moved by the fingers to disconnect the mechanism, thus allowing the table to be actuated directly by the hand. The table is connected again instantly when required, without disturbing the original setting of the mechanism.

The upper part of the work table may be swiveled to any desired angle within its range for grinding tapers; the wheel head may be swiveled to any required angle and is operated by power cross feed. This automatic feed may be adjusted to operate to the fraction of a thousandth of an inch. Both the wheel-stand swivel and the swivel table for the work are so graduated as to facilitate accurate settings.

The spindles for the grinding wheels used on this machine are mounted in ball bearings in quills. These quills and spindles are designed to suit all kinds of work within the capacity of the machine. Some typical forms are illustrated by Fig. 2, the upper spindle in the group being especially adapted for grinding very small holes. The nose of this spindle has a taper hole and is provided with wheel arbors of various sizes and lengths for work within its capacity, from 1/64 inch up to two inches diameter. Other spindles are made for grinding longer holes, for larger wheels and for heavier operations.

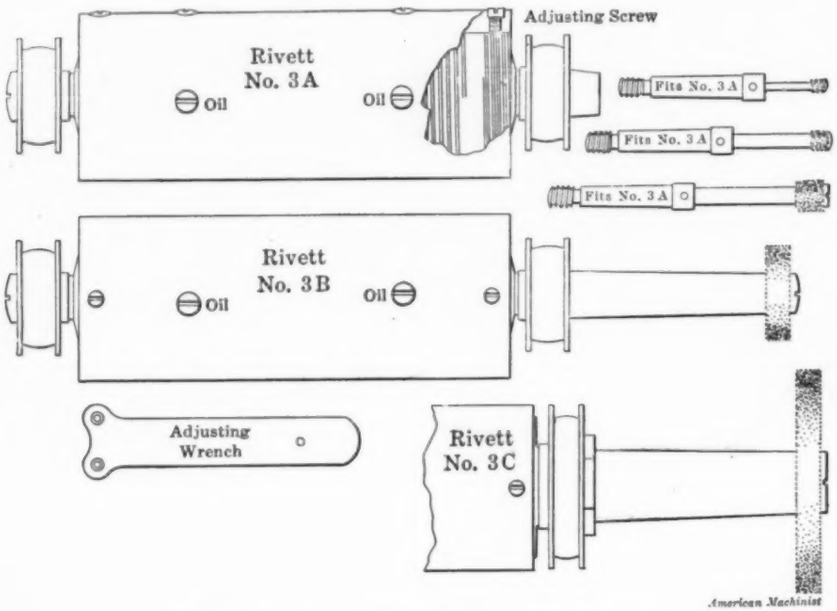


FIG. 2. SPINDLES FOR RIVETT INTERNAL GRINDER

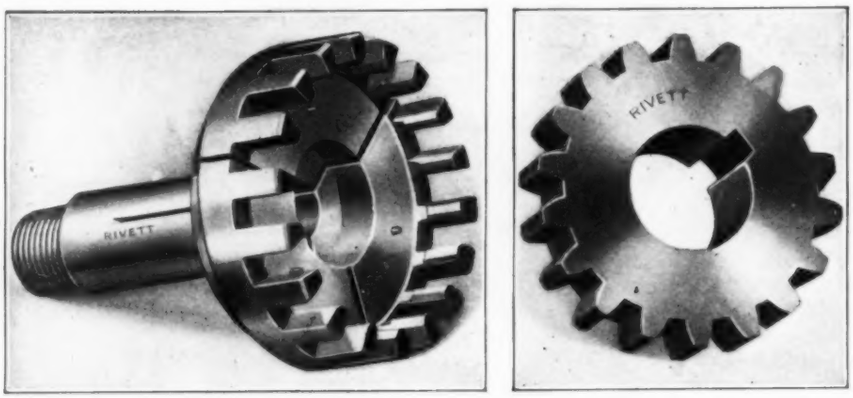


FIG. 3. CHUCK AND GEAR FOR RIVETT INTERNAL GRINDER

Fig. 2 shows the two pulleys by which the spindle is driven uniformly from both ends from the two larger pulleys at the back of the wheel head. As stated, the spindles run on ball bearings and adjustment is readily effected by loosening two set screws near the end of the quill and turning the threaded adjusting member, which is clearly shown in the engraving.

An interesting form of chuck for holding a gear while grinding the bore is illustrated by Fig. 3. This spring chuck is toothed as indicated, to admit the teeth of the gear, the chuck teeth being narrow enough to pass between the gear teeth and contact with the work at the bottom of the teeth, thus holding the gear true during the grinding operation.

A Nurling Tool and a Hand Vise

Two new tools of interest to toolmakers and others are illustrated herewith.

The nurling tool, Fig. 1, is designed for use in the hand for nurling small, light work in the tool lathe, the work being well supported between the three nurls. The maximum opening obtainable between the nurls is ¾ inch, and any size from this down may be nurled by holding the tool in the hand. The handle by which the tool is adjusted to set the nurls to the work is hollow and holds an extra set of nurls for finer work. The total length of the device is seven inches when fully open. The body is formed of a drop forging and case-hardened.

FIG. 1. A NURLING TOOL

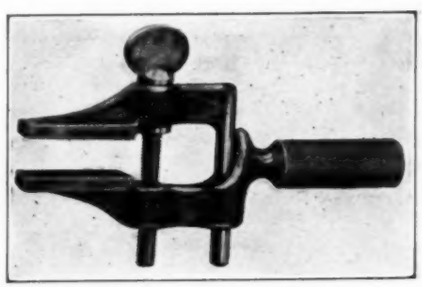


FIG. 2. A HAND VISE

The hand vise illustrated in Fig. 2 has jaws two inches long by one inch wide and opens two inches. The vise is 7½ inches long over all. The construction is so clearly shown by the halftone that little description is necessary and its applications in the shop will be obvious to practical mechanics. All parts are drop-forged and case-hardened and, like the nurling tool, the vise presents a very neat appearance. The two tools illustrated are manufactured by the Wade Machine Company, Boston, Mass.

Geometric Chaser or Die Grinder

The accompanying halftones illustrate a machine built by the Geometric Tool Company, New Haven, Conn., and designed for grinding any make of thread chaser. This machine is also equipped with a second grinding wheel which may be employed for ordinary tool grinding. The vise in which the die chaser to be ground is held, is universally mounted and the adjustments provided are such that the chaser may be ground square or to any radius, according to its form, and whether right or left hand. This vise may also be set to permit grinding the die throat to any desired clearance.

The chaser to be ground is clamped in the vise by means of the upper hand wheel shown in Figs. 1 to 3. The vise jaws are of the same form as the clamping device in the die head and the chaser is held in exact position for grinding. One chaser is ground at a time, but, as the adjustment of vise and feed table when set remains the same, uniformity of grinding is assured.

In grinding milled chasers, which are ground mostly on the throat, the feed table is lowered to bring this part of the chaser under the wheel. The chaser is inserted in the vise *L*, Fig. 2, brought up against the stop and clamped with hand wheel *C*. The table is then elevated by hand wheel *G*, Fig. 3, to give the proper chamfer. For brass or other free-cutting metals, or where the thread is to run close to a shoulder, the chaser should contact with the grinding wheel some distance below the center, giving the die a chamfer of approximately 45 degrees. For ordinary cutting it should be raised until the chamfer is about 30 degrees.

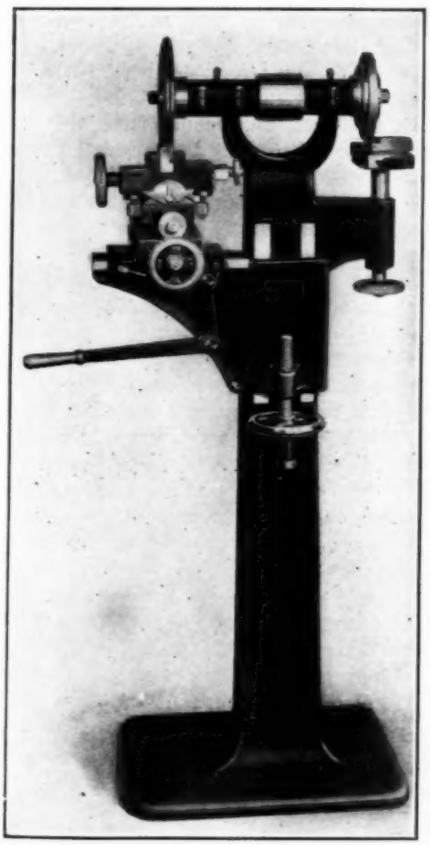


FIG. 1. GEOMETRIC CHASER OR DIE GRINDER

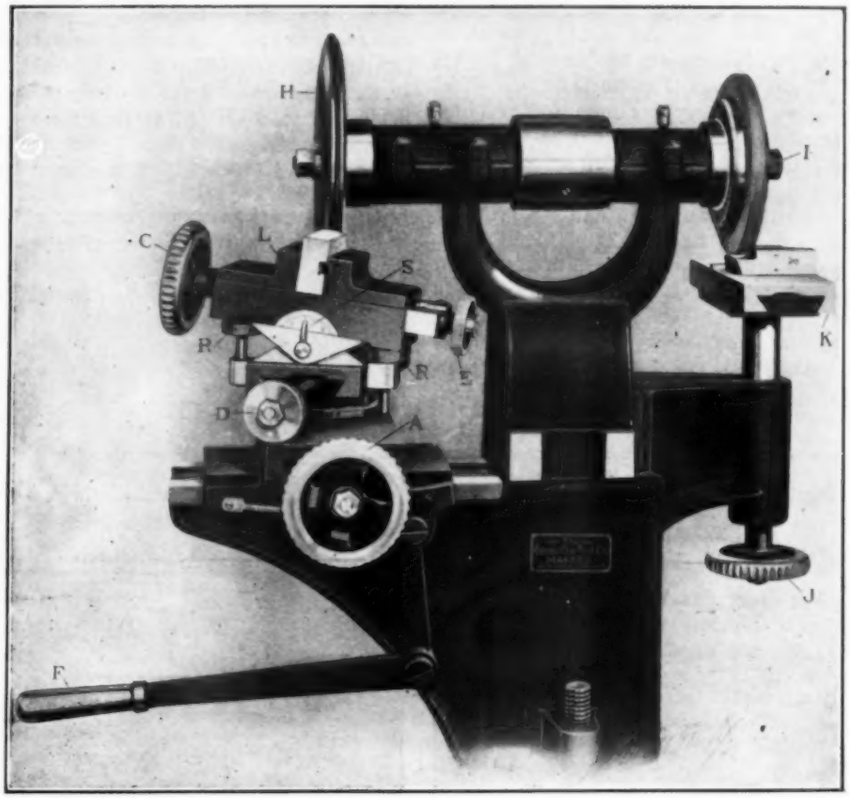


FIG. 2. ADJUSTMENT FOR GRINDING CHASER THROAT

After one chaser is ground to the proper angle of clearance, ring *B*, Fig. 3, is adjusted to give the amount of feed necessary and clamped. When the first die of the set is ground, the table is run back, the chaser removed, and the second chaser inserted. The table is then returned to grinding position and the chaser passed back and forth against the face of the wheel by the hand lever *F*, hand wheel *A* being turned meanwhile to feed the work forward until the check mark coincides with the second mark on the fixed arm. At this point pins provided for the purpose automatically stop the feed, and all chasers are ground uniformly. During this operation swivel *O* is clamped by handle *P*, Fig. 3.

Milled chasers require touching up lightly on the cutting edges occasionally to keep the edges sharp and this is accomplished by placing the chaser flat on table *K*, Fig. 2, adjusting the table by the hand wheel *J* until the work just touches the wheel, then moving the carriage back and forth under the wheel. Whether grinding on throat or face the remaining chasers in the set are ground with the same adjustment.

In grinding tapped chasers the work is held as in Fig. 3, where the scale on the swivel of the vise *O* is shown graduated in thirty-seconds of an inch. This scale is set to the radius of the die, minus the single depth of thread, the chaser placed in the vise and clamped as before. The jaws of the vise are then set to right or left just sufficient to give proper clearance. Part *O* is released by handle *B*,

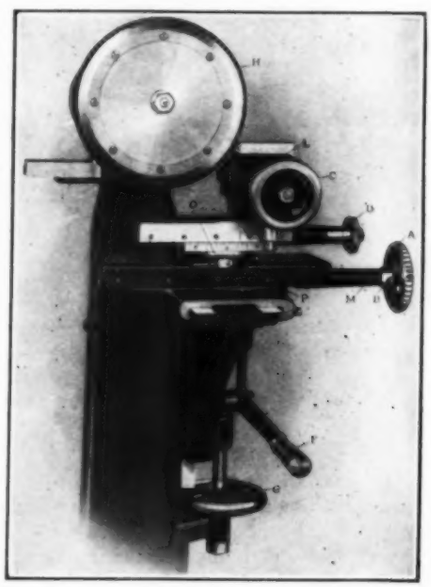
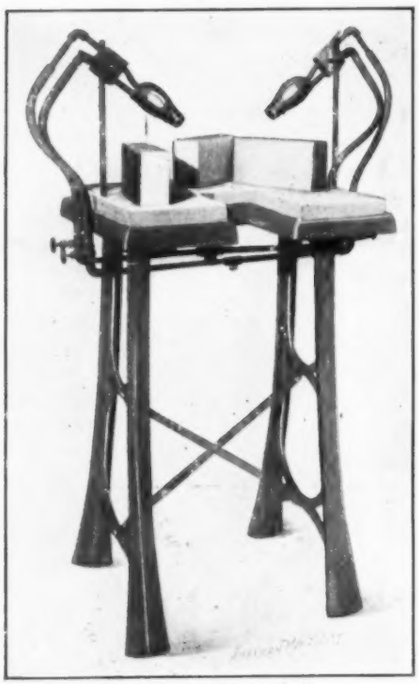


FIG. 3. ADJUSTMENT FOR GRINDING CHASER THROAT

then swiveled about the grinding wheel, at the same time the hand wheel *A* is used for feeding up to the stop as already described. The small nurled wheel *D* gives the proper radius for grinding tapped dies in connection with the scale reading. The small nurled wheel *E*, Fig. 2, moves the vise from right to left of the pivot for clearance and for grinding right- or left-hand chasers. Vise *L*, Fig. 2, is tilted by screws *R R* in setting to grind chasers for Acme or square threads of coarse pitch or for double or triple threads. In adjusting, a convenient method is to insert the chaser in the vise, then adjust to conform closely to the original grinding.

New Scott Gas or Gasolene Brazing Furnace

The accompanying halftone illustrates a new brazing furnace designed and brought out by C. U. Scott, Davenport, Iowa.



FRONT VIEW OF SCOTT BRAZING FURNACE

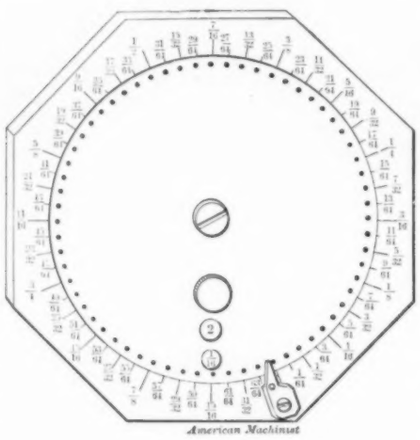
The furnace requires very little explanation. The heat can be taken without scaling the work, and the flame, which can be generated by city or gasolene gas, will not blow out while in operation.

A heat of 1872 degrees is instantly produced upon lighting, and as will be noted, the burners are arranged so as to cover the entire top of the furnace.

The furnace is simple in design and construction, as will be noticed from the illustration.

Fraction Adder

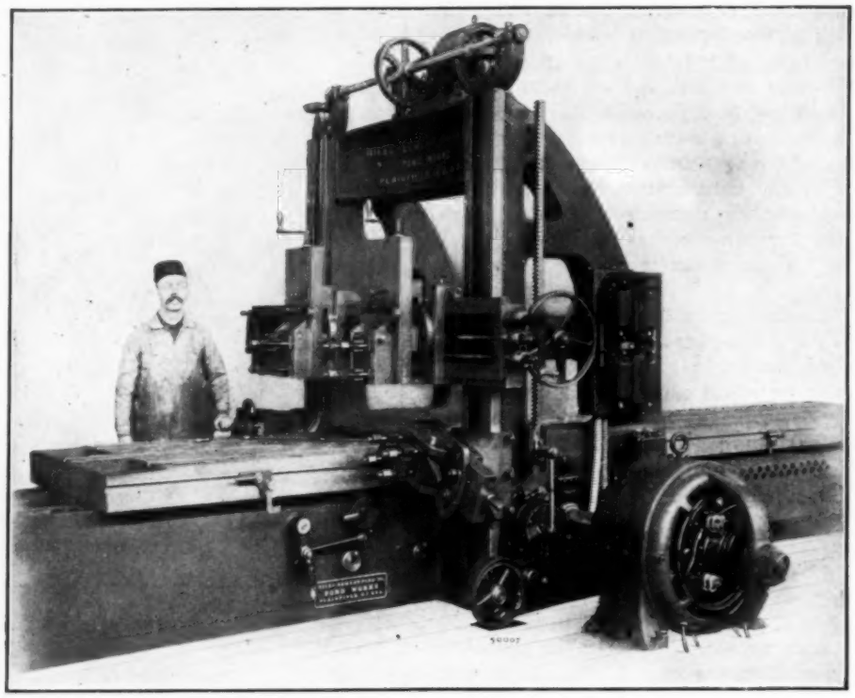
A device for adding fractions, manufactured by the Keuffel & Esser Company, Hoboken, N. J., is illustrated in the accompanying line cut. By means of this device it is possible to mechanically add a series of fractions by sixty-fourths and multiples, up to a total of 16 integers. The operation is performed by placing a stylus point in the small indentation in the circumference of the main disk opposite the fraction to be added, and then turning the disk until the stylus comes against the stop at the bottom. The result of each step of the addition is shown by a counter, through the two windows in the disk. If desired this counter may be set to zero by means of the nurled knob.



FRACTION ADDER

Reversing Motor Drive for Planers

In the accompanying halftone there is shown a reversing motor drive for planers, now being put on the market by the Niles-Bement-Pond Company, New York City, the product of the Pond Works. The object of this form of drive is to do away with shifting belts, clutches, etc., for reversing the planer platen, this being accomplished by the reversal of the electric motor by suitable switches.



POND PLANER WITH ELECTRIC REVERSING DRIVE

A reversing electric motor of the interpole type, with 4 to 1 speed variation range is directly connected to the shaft of the planer driving pinion. On the platen of the planer there is a pilot switch controlled by the motion of the platen, similar to the ordinary belt-shifting device for belt-driven machines. This pilot switch controls solenoid switches on a panel mounted on the side of the planer. The solenoid switches control the motor for starting, accelerating, stopping and reversing. The arrangement of the switches is such that when the current is cut off, the dynamic action of the motor, acting as a generator and with the full field strength, brings the platen to a quick but easy stop. The motor is then reversed, with full field strength, to start the platen in the opposite direction. Following this, the solenoids automatically cut out resistance from the armature circuit, and add resistance to the field circuit, for increasing the speed to that desired.

It is claimed that the arrangement is such that the reversing current cannot be

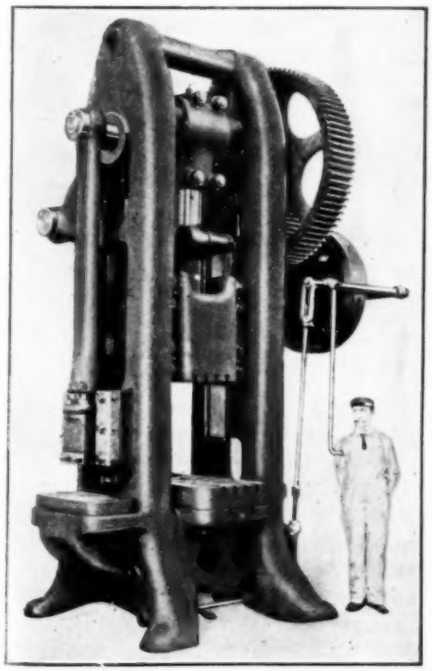
put upon the motor until it is brought practically to a stop, in this way avoiding the heavy overload which otherwise would be thrown upon the motor. It is possible to set the dogs operating the pilot switch for a minimum platen stroke of 2 inches and the platen will come to a stop within a limit of ⅛ inch.

Upon the controlling panel are two rheostats which control the speed of the motor in the two directions, independently, as suitable to the work in hand. When these rheostats are set, the further operation is entirely automatic for the speeds thus picked out. It is furthermore possible by hand manipulation of the pilot switch, during the travel of the platen, to reduce the speed of the stroke for any portion of the travel, as might be desired if planing a number of pieces of varying hardness. It also can be brought to a stop at any point, by hand control.

It is claimed that as the greater portion of the momentum of the parts is in the motor armature the shock of stopping and reversal is largely removed from the gears.

Heavy Trimming Press

The Ferracute Machine Company, of Bridgeton, N. J., has recently built from designs of its president, Oberlin Smith, several new heavy trimming presses, some of which were calculated for pressures of 300 tons, and others for 200 tons, the illustration showing one of the 300-ton presses. It contains a side punch for similar work of a lighter character, adding considerably to the capacity of the press. The distance between columns is 32 inches, the bed being 30 inches right to left and 50 inches front to back, the bed, bolster and ram containing T-slots for die clamps. The bed of the side punch is 15 inches by 30 inches.



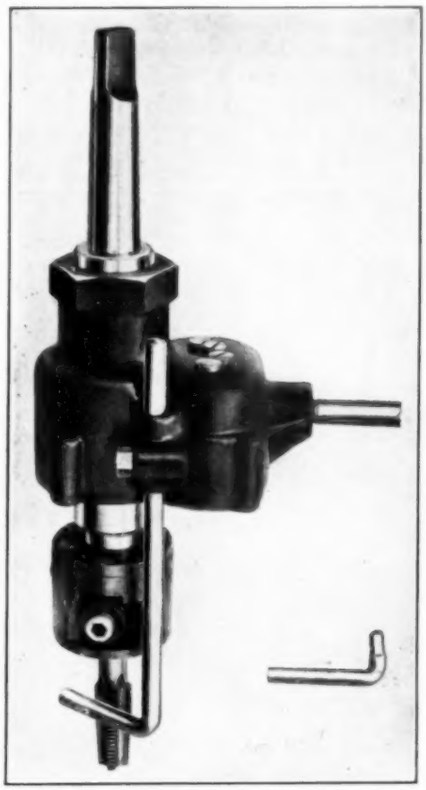
HEAVY TRIMMING PRESS

The stroke of the main press is 12 inches with 10 inches adjustment, the side punch having 3-inch stroke. The shaft is a steel forging having a diameter of 9 inches at the journals and 11 inches at the crank. The flywheel is 40 inches diameter, 7 inches face and weighs 1100 pounds. The friction clutch enables the operator to start or stop the press at any portion of its stroke.

The machine is double geared, the ratio of gearing being 50 to 1, and occupies a floor space of 10 feet right to left and 7 feet 6 inches front to back. It is 14 feet high and weighs about 68,500 pounds.

A Tapping Attachment for the Drill Press

The halftone shows a tapping attachment which is being put on the market by John H. Dorman, 1 Bethune street, New York. This attachment is built in three sizes, 0 to ⅜, ⅜ to ¾ and ¾ to 1 inch. The body of the attachment is of aluminum, the gears are of steel and all parts subject to wear are hardened. The chuck is of the floating type and centers the tap to a female center in the end of the main spindle. The cover of the body is secured by means of case-hardened screws, and may be readily removed for inspection. The chucks of the two larger sizes are provided with a sliding plate, not shown, one end of which is provided with a clearance hole for the tap shank. The other end has a blind conical hole. By sliding this plate so that the conical hole is in line with the spindle, small taps can be centered by the conical hole and used in these larger attachments.



A TAPPING ATTACHMENT

Substantial Face Plate Jaws

The illustrations show a new line of face-plate jaws being made by the S. E. Horton Machine Company, Windsor Locks, Conn., which have several very convenient points. These provide for substantial bolting to the face plate and the end or sides if desired, as well as being conveniently shaped for strapping in almost any position. The end of the jaw base being 45 degrees, allows them to be placed very close together as can be seen in this Fig. 1, and in this position a single strap acts on two jaws. Fig. 2 shows the jaws placed at the edge of the face plate with the end projecting and gives a large capacity when used in this way. The distance which these can project beyond the face plate depends, of course, on the clearance between the face plate and the lathe bed. It is sometimes desirable to use the side holes for dowels or locating pins so that the jaws may be replaced in a certain position when desired. These are made with either cast-iron or cast-steel bases, while the jaws and screws are of steel. The base can be provided with either a tongue or groove as may be desired. They are made in sizes ranging from 8 to 14 inches in length, and are capable of handling very heavy work.

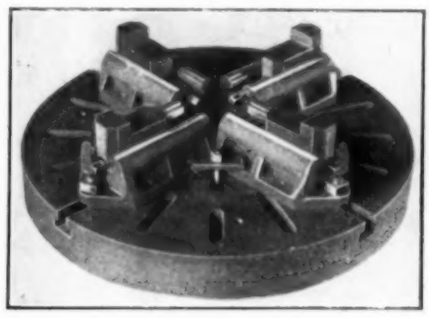


FIG. 1. FACE-PLATE JAWS IN CLOSE QUARTERS

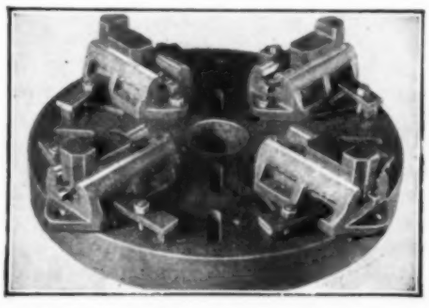
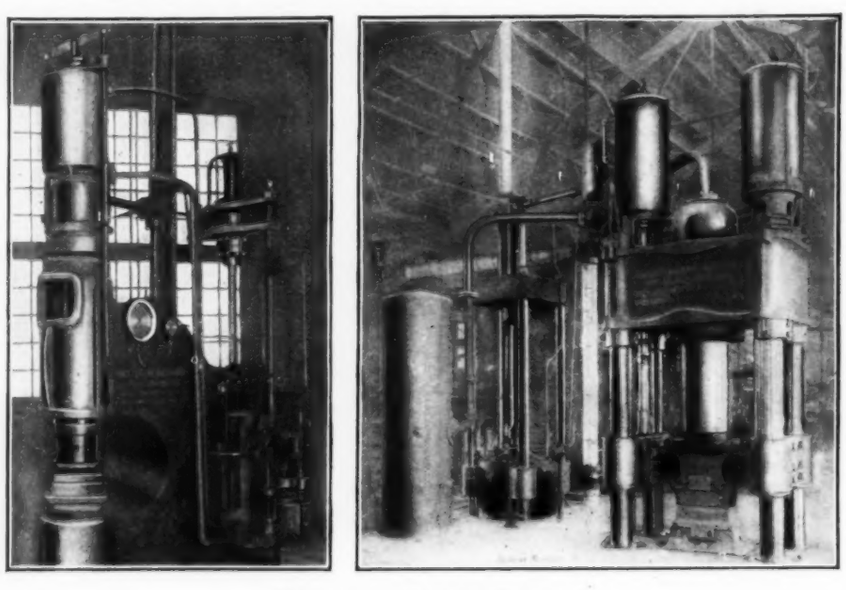


FIG. 2. SET OUT FOR LARGE WORK

High Speed Forging Press

The accompanying halftones illustrate a type of high-speed forging press developed by Davy Brothers, Ltd., of Sheffield, England, and manufactured in the United States by the United Engineering and Foundry Company, Pittsburg, Penn. This press is a development from the old style hydraulic press and hydraulically operated intensifier, followed by the steam intensifier. In this case the high-pressure stroke produced by the steam intensifier is limited to the few inches of travel required in actual forging work, while by means of steam balancing cylinders a comparatively long, quick stroke of low pressure is secured for the placing of the work and the dies.

The notable feature of these new presses is that the entire control of both the low- and high-power portions of the acting stroke and the low-power motion of the return stroke, is by means of one lever, and the movement of the press head is in direct proportion to the movement of this lever. By this means it is claimed that the employment of different levers for different motions and pressures is obviated, together with the possibility of false movements sometimes leading to disastrous results. The movement of the control lever back of the vertical center line corresponds to the light stroke which is from 2 to 6 feet, according to the size of the press, and



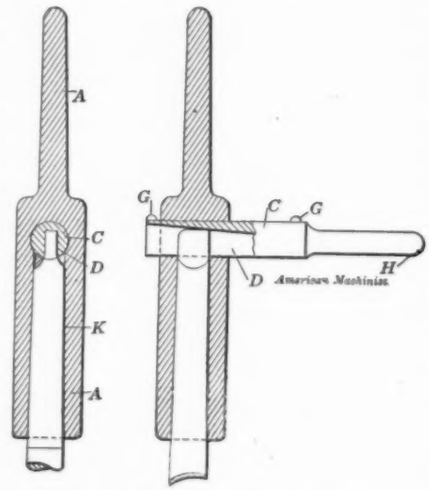
HIGH-SPEED FORGING PRESSES

forward of this line is the power stroke from 2½ inches to 6½ inches, according to the size of the press. It is also possible to repeat the heavy or forging stroke as often as desired, at a speed as high as 150 per minute on the small presses, down to 60 on the large ones. It is claimed that this comparatively slow, heavy forging stroke has a benecial effect on the steel.

In cutting or punching, the hand lever can be set for a certain travel and the press will not ride forward, even though the resistance is suddenly and entirely removed. This is claimed to be an advantage for safety.

Drill Holder for the Lathe

The engraving shows an appliance for holding drills or similar tools in the lathe. The shank *A* of the holder is turned to fit in place of the lathe center. The outer end *K* is bored to fit the drill or tool



DRILL HOLDER FOR THE LATHE

bottom of the groove is cut on an incline, forming an ever ready drift pin to force the drill from the holder. The end of the pin *H* rests on the lathe-tool rest when drilling. The two screw heads *G* prevent the two parts of the holder from becoming separated when the holder is not in use. This holder has been brought out by the Linsley Tool Company, 13,370 Superior avenue, Cleveland, Ohio.

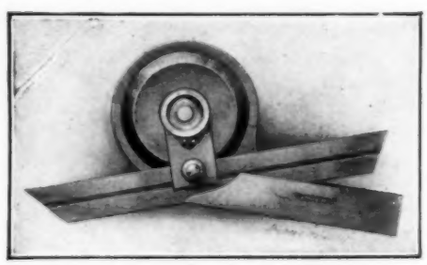
Extension Lamp Cord

The L. A. Williamson Company, 79 Milk street, Boston, Mass., is marketing a device for connecting an incandescent lamp to any convenient lamp socket by a flexible cord. About 15 ft. of lamp cord is wound in a case in the same way as a surveyor's tape measure and carries a plug on the end. On one side of the case is a socket for any standard lamp and the device affords a particularly convenient method of getting light temporarily in dark places either in the shop or the office.

A New Bevel Protractor

The bevel protractor shown is made by the Brown & Sharpe Manufacturing Company, of Providence, R. I., and is an accurate and inexpensive tool for laying out or establishing angles for both draftsmen and mechanics.

One side of the protractor is flat, which allows it to be laid flat on the paper or work. The dial is accurately graduated in degrees over an arc of 180 degrees, reading from zero to 90 degrees each way. As will be noticed, this protractor has no vernier.



BEVEL PROTRACTOR

The large central stud is hardened in order to eliminate as much wear as possible and allows the dial to be held rigidly in position.

The blade of the protractor is free to move its entire length independently of the dial, making it well adapted for work where other protractors cannot be used. Care has been taken in making the joints so that there is very little chance for dust to accumulate and cause inaccuracies in the measurements.

Master Mechanics Convention

The annual convention of the Railway Master Mechanics' Association was held in Atlantic City, June 20 to 23 inclusive, and contained a large number of interesting exhibits. While the number of machine tools shown was not as great as in former years, many of the exhibits were particularly interesting and attracted considerable attention. Among these was the combined exhibit of the Celfor Tool Company and the Colburn Machine Tool Company, in which some remarkably fast drilling was being done. Cast iron was drilled at the rate of over 31 inches per minute, with a 1⅛-inch drill, without in any way injuring the drill or interfering with the machine in the least. Holes from one to three inches were drilled at remarkable speeds. An interesting example, which proves that the twisted drill does not run when it strikes a blow hole, was found in the center of a large cast-iron block where the drill had run straight through, regardless of blow holes which connected the two holes, although the wall between these holes was less than ⅛ of an inch thick at either top or bottom.

The Coates-Clipper Manufacturing Company attracted attention with its mechanically driven chipping hammer and flexible drilling sets. Both the R. K. LeBlond Machine Tool Company and F. E. Reed Company exhibited gear-head lathes for railroad work, while the Landis Tool Company, Hendey Machine Company, Windsor Machine Company, Dreses Machine Tool Company, National Acme Machine Company, were represented. The Charles H. Besly Company exhibited one of its large disk grinders. The J. H. Williams Company had several of its motion boards in operation, showing the working of its "Vulcan Bijaw" and "Ratchetless Ratchet Rench."

Both the Davis-Bournonville Company and the Linde Air Products Company had very interesting exhibits of both welding and cutting. The Linde Company has a cutting torch so placed that a plate of heavy bar steel, possibly 1⅛ inches, could be revolved beneath it so as to cut off rings from the outside of the plate. These largely resemble piston rings and attracted considerable attention. The Davis-Bournonville Company, in addition to its exhibit, also assisted by welding the framework of apparatus being installed by the U. S. Wave Power Company.

The other exhibitors along the line of machine tools and appliances were American Vanadium Company, Armstrong-Blum Manufacturing Company, Armstrong Brothers Tool Company, F. S. Bowser & Company, Buck Boring Bar Company, Carborundum Company, Detroit Hoist and Machine Company, Henry Disston & Sons, Fairbanks Company, Fairbanks, Morse & Company, Walter H. Foster Company, Gilbert & Barker Manufacturing Company, Goldschmidt Thermit Company, Greene, Tweed & Company, Edwin Harrington Son & Company, Independent Pneumatic Tool Company, Keystone Drop Forge Works, Landis Machine Company, Manning, Maxwell & Moore, Niles-Bement-Pond Company, North Brothers Manufacturing Company, Revolute Machine Company, Rockwell Furnace Company, Royersford Foundry & Machine Company, William Sellers & Company, Stoever Foundry and Machine Company, Strong, Carlyle & Hammond, Tindel-Morris Company, Toledo Pipe Threading Machine Company, Union Manufacturing Company, U. S. Metallic Packing Company, Watson-Stillman Company, Wright Wrench Manufacturing Company, Yale & Towne Manufacturing Company.

Actual Breaking Loads for Gear Teeth

In making these tests, several teeth were cut away so that a bar with an edge not over ¼ inch wide could be placed on a tooth at the pitch line. The load was gradually applied. Unfortunately, in these tests the elastic limit was not noted, but may be assumed to be as one-half of the breaking load. The ultimate strength of the 2½ pitch gears was 70,000 pounds per square inch, the elastic limit, 35,000 pounds. On the 3 pitch gears, the ultimate strength was 60,000 pounds, with an elastic limit of 30,000 pounds per square inch. These data are placed in form of a table which shows the safe load per inch of face, also the safe load per inch pitch per thousand pounds safe working load. This result compares very favorably with data obtained from other sources. The gears in each case were Brown & Sharpe standard 14½ involute cast steel, in the neighborhood of 70 teeth.

Example:

The safe static load on a gear 65 teeth 1½-inch pitch, 6-inch face, constructed of cast steel, allowing a safe working stress of 15,000 pounds per square inch would be $125 \times 1\frac{1}{2} \times 6 \times 15 = 16{,}876$ pounds. For different numbers of teeth the load per inch pitch per 1000 pounds safe working load should be proportioned according to the value given for Y in the Lewis formula for the strength of gear teeth.

Pitch.	Breaking Load. 5 Inch Face.	Breaking Load. 1 Inch Face.	Full Load for Elastic Limit of Material.	Safe Load per Inch of Face.	Safe Load for 1 Inch Pitch per 1000 Pounds per Square Inch.	Safe Load per Inch Pitch per 1000 Pounds per Square Inch.
2½	112,000	22,400	11,200	5,600	160	125
3	80,000	16,000	8,000	4,000	130	

The First Passenger Airship

Count Zeppelin is to be congratulated on the successful inauguration of his airship service in Germany, especially for the determination and perseverance displayed in spite of many disheartening mishaps. The new airship, the Deutschland, is 485 feet long, 46 feet wide and holds 671,004 cubic feet of gas. It has three motors of 110 horsepower each. The rated speed is 35 miles an hour and this was practically maintained in the initial flight with passengers (reports vary from 12 to 20 in number) from Friedrichshafen to Düsseldorf. The fact that Count Zeppelin is 72 years old should spell encouragement to those who think themselves old at 45 and help to dispel the illusion that modern life has no active place for the man who is past middle age.

An Opportunity for Foreign Business

The firm of Post, van der Burg & Co., Willemsplein 11-12, Rotterdam, Holland, dealers in machine tools and accessories, invite American manufacturers to send them catalogs and price lists covering tools and equipment of all kinds.

This firm is open to enter into agency arrangements for several classes of tools.

Increasing Shop Capacities

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Manchester (Ga.) Cotton Mills will build an addition.

The Goyne Pump Works, Ashland, Penn., is enlarging its plant.

Fittings, Limited, Oshawa, Ont., is erecting a $25,000 stock room.

The Tuttle Motor Company will erect a plant at Canastota, N. Y.

It is reported the American Textile Company will build a new mill.

James Strong, Ruscom Station, Ont., is erecting a $25,000 stock room.

The Library Bureau, Chicago, Ill., is to erect an addition to its plant.

Ohio State Hospital for Insane, Columbus, Ohio, will install new boilers, etc.

The Glenlyon Dye Works, Phillipsdale, R. I., will improve its power plant.

The plant of the Keokuk (Iowa) Box Company, recently burned, will be rebuilt.

The Keiper and Heller Knitting Company will construct a mill in Easton, Penn.

The Utah Ice and Cold Storage Company, Salt Lake City, is erecting a new plant.

The Coffin Show Case Company, East Providence, R. I., will build an addition.

The Woonsocket (R. I.) Spinning Mills is having a large addition to its plant built.

The Mosaic Tile Company, Zanesville, Ohio, is making extensive additions to its plant.

The Williams Piano Company, Oshawa, Ont., is making improvements at its plant.

The town of Ladner, B. C., will make extensive additions to its water-pumping plant.

Two additional boilers will be installed in the Peabody (Mass.) Electric Light plant.

Henry Whonroy, Towanda, Penn., is seeking suitable location for woodcarving plant.

The Lehigh Portland Cement Company will build a $200,000 plant in Mason City, Iowa.

The Hamilton Ice Company, Camden, N. J., will increase the capacity of its power plant.

American Felt Company, Glenville, Conn., contemplates installing additional machinery.

The Leisy Brewing Company, Cleveland, Ohio, will erect a new $15,000 boiler house.

The city of Dauphin, Man., will spend $10,000 on new electric-lighting equipment.

The Saskatchewan Power Company will equip a $1,000,000 plant near Saskatoon, Sask.

F. S. Ward & Sons, Jersey City, N. J., leather manufacturers, are enlarging their plant.

The city of Williamston, N. C., voted to issue $10,000 bonds for an electric-light plant.

The Jeanesville Iron Works, Hazleton, Penn., is contemplating extensive improvements.

T. J. Dunn & Co., Copley, Penn., cigar manufacturers, are building a four-story addition.

The Imperial Furniture Company, Grand Rapids, Mich., will erect a four-story addition.

Contract has been awarded for a new plant for the Saginaw (Mich.) Sheet Metal Works.

The Joseph Campbell Company, Camden, N. J., will build an addition to its soap factory.

The Dakota Power Company, of Rapid City, S. D., will erect an additional power station.

The Northwestern Knitting Company, Minneapolis, Minn., will erect a new $125,000 factory.

The Watson Wagon Company, Canastota, N. Y., is preparing to building additions to its plant.

The city of Waco, Tex., will install two 350-horsepower boilers and one 5,000,000-gallon pump.

The Gordon Ironsides and Fares Company will locate a large packing plant at Moose Jaw, Sask.

The Mohawk Electrical Company, Albany, N. Y., is said to be looking for site for a new plant.

The Sutherlin (Ore.) Land and Water Company will erect an additional electric-light plant.

Swift & Co. will soon commence the erection of refrigerator plant on Broad street, Bangor, Me.

The Crowell Publishing Company, Springfield, Ohio, will erect a four-story addition to its plant.

The Columbia Fruit Jar Company, La Salle, Ill., is tryng to find suitable site for a new plant.

The British Columbia Casket Company is building a plant at Burrard Inlet, near Vancouver, B. C.

The Mt. Clemens (Mich.) Garage and Motor Sales Company will erect a new two-story garage.

Wm. H. Keller & Son, Easton, Penn., piano manufacturers, will erect a four-story factory building.

The Muscatine (Iowa) Button Company will establish a branch factory in Poughkeepsie, N. Y.

The Raymond Foundry and Machine Company, Tacoma, Wash., is building a new main machine shop.

The Auto Body Company, Lansing, Mich., will erect a three-story building to be used as a machine shop.

Kind & Landesmann, Camden, N. J., will increase the capacity of its plant. New boiler will be installed.

The Wyandotte Silk Throwing Company, South Bethlehem, Penn., is erecting a new two-story building.

The Central Massachusetts Electric Company, Palmer, Mass., is building an addition to its boiler room.

Royal Worcester Corset Company, Worcester, Mass., will spend $10,000 in improving its power plant.

The Howard Auto Car Company, Galion, Ohio, is now having plans prepared for a new $60,000 factory.

The Vulcan Hard Fibre Company will erect a large factory along the Lehigh Valley Railroad at Easton, Penn.

The plant of the Nicolet Falls Pulp and Lumber Company, at Danville, Que., recently burned, will be rebuilt.

Pettinos Brothers, Bethlehem, Penn., manufacturers of foundry facings, graphite, etc., are building an addition.

The Victor Talking Machine Company, Camden, N. J., has awarded contract for the construction of a garage.

The C. E. Lindsley Company, manufacturing cement blocks and bluestone, is erecting a plant at Irvington, N. J.

C. J. Laughlin has been granted a franchise in Welland, Ont., for street railway. Will commence work right away.

Plans are being drawn for a plant for the Ann Arbor (Mich.) Motor Company. George Scott, Ann Arbor, is architect.

The Kenneth (Mo.) Tight Barrel Stave Company is considering the removal of its plant to some other locality.

The Orr Manufacturing Company, Attleboro, Mass., making shoe lasts, is looking for suitable location for a plant.

Stanley G. Flagg Company, Stowe, Penn., is in the market for a universal milling machine and a toolmaker's lathe.

The Standard Oil Company is preparing to rebuild a plant at Knoxville, Tenn., which was recently destroyed by fire.

The Rockwell Manufacturing Company is building a plant at West Chester, Penn., for the manufacture of gas engines.

The Southern Can Company, Baltimore, Md., has plans for a new plant to be erected at Wolfe and Lancaster streets.

George Dodds & Sons, Xenia, Ohio, marble manufacturers, have had plans prepared for a large addition to their plant.

The Bement (Ill.) Water Works is driving a 150-foot well and is in the market for motor to gear to pumping head.

Cutler, Dickerson Company, Adrian, Mich., is to erect a new large grain elevator and warehouse to replace present one.

The International Brewery Company, of Auburn, N. Y., will construct a large cold-storage plant at Rochester, N. Y.

The Fay Automobile Company, Chicago, Ill., is looking for suitable location on which to erect a new and modern plant.

The Leighton Machinery Works, East Manchester, N. H., building knitting machines, will erect a new two-story building.

The Price Implement Company, Zanesville, Ohio, has constructed large automobile garage, which is not yet fully equipped.

The Michelin Tire Company, New Brunswick, N. J., will erect an addition and enlarge some of the present buildings.

The Starr Automobile Company is planning the erection of a plant at Downing, Wis., which is expected to employ 500 men.

The Golden Belt Manufacturing Company, Durham, N. C., manufacturing cotton cloth and bags, will erect a $30,600 addition.

The Templeton-Barrett Company, Milwaukee, Wis., manufacturing hardware specialties, is seeking site for a new plant.

The Gillie Engine Company, Tonawanda, N. Y., has purchased an additional building which will be converted into a boiler shop.

The Monarch Manufacturing Company, Ironville, Ohio, manufacturing axle grease and lubricating oils, will erect a new plant.

The Marquette (Ill.) Globe and Valve Company is making investigation with a view of securing a location for a new plant.

The Dominion Dry Dock Company has filed plans for dry docks and shipbuilding and repairing plants at Levis, Que., and St. John, N. B.

B. F. Smith & Co., Pawtucket, R. I., have secured contract for the construction of the Whitman yarn mill, at South Lawrence, Mass.

The United States Barbers Furniture Company, Chicago, Ill., will erect a new $50,000 factory on Western avennue, near Ohio street.

The Dent Hardware Company, Fullerton, Penn., is erecting two iron-toy foundries which will give employment to 75 additional molders.

The Danvers Bleachery Company, Peabody, Mass., is erecting a four-story addition to be equipped with sewing machines for making bags, etc.

The Foster Gear Company, Columbus, Ohio, has succeeded the Columbus Screw and Machine Company and will build an addition to its plant.

L. A. Wartman is erecting a five-story building on Hamilton street, Allentown, Penn., for the manufacture of harness and leather goods.

The Kinemacolar Company has purchased site at Allentown, Penn., on which to erect a plant for the manufacture of moving-picture machines.

The Harley-Davidson Motor Company, Milwaukee, Wis., has been granted a permit to erect a $20,000 factory at Thirty-eighth and Chestnut streets.

The Butterick Publishing Company, New York, is said to be contemplating the erection of a plant for the manufacture of Manila tissue paper.

Julius Harksell, 355 Eighth street, San Diego, Cal., is planning the erection of a two-story factory for the manufacture of store and office fixtures.

The Pere Marquette Railroad will spend $50,000 in improvements at its shops in Saginaw, Mich., including a new boiler house and new tool house.

Eben C. Willey, of Fall River, Mass., is said to be interested in the establishment of a large new cotton mill to be erected in the New England section.

George N. Hall, Pewaukee, Wis., manufacturing hardware specialties, will move to Council Bluffs, Iowa, where a new and larger plant is being erected.

The Fire Proof Film Company has purchased site in Rochester, N. Y., on which a plant for the manufacture of films and photo supplies will be erected.

C. B. Rice, of Garyville, La., will erect a $15,000 foundry and machine shops in Columbia, Miss., on the lot purchased from the Columbus Commercial Club.

The Kelly-Atkinson Construction Company, Chicago, Ill., will move to Rondout, Ill., where a new plant will be erected. The company constructs bridges.

The Seitz Auto and Transmission Company, now at 225-229 Becher avenue, Detroit, Mich., will move to Wyandotte, where a new plant will be erected.

The Charter Oak Stove Company, St. Louis, Mo., is having plans drawn for a new foundry building for the production of gray and malleable-iron castings.

The B. C. K. Motor Company, York, Penn., has awarded the contract for the erection of a three-story addition to be used for general automobile manufacturing purposes.

O. F. Lidke, of the Lidke Company, 202 Tolsma building, Detroit, Mich., is interested in the organization of a new company to manufacture Tungsten incandescent lamps.

The Muscatine (Iowa) Motor Company has changed its name to the Golden West Traction Company. Plant will be enlarged. The company will make gas traction engines.

The Voelkner & Harry Manufacturing Company, Detroit, Mich., has awarded contract for the construction of a new factory. The company manufactures hardware specialties.

The Seagrave Company, South Columbus, Ohio, which manufactures all kinds of self-propelling fire apparatus is having plans drawn for extensive additions to its plant.

Final preparations are said to be under way for beginning work on a new plant for the Rock Island (Ill.) Plow Company. The plant will eventually employ about 5000 men.

The Watson Manufacturing Company, Jamestown, N. Y., making metal-frame screen doors and windows, has awarded contract for the erection of a five-story addition to its plant.

The Canada Foundry Company has purchased the shipyard of the Canada Shipbuilding Company, at Bridgeburg, Ont., and will convert same into a structural steel plant.

The W. H. Miller Mill and Mine Supply Company, Columbus, Ohio, is having plans drawn for additions, including a new machine shop to be fitted with modern machinery.

The American Gas Machine Company, Albert Lea, Minn., has let contract for the erection of a new $55,000 factory. Lathes, drill presses, vises, bench, tools, motors, etc., are required.

Horace C. Stillwell, of Anderson, Ind., is president of a new concern known as the Bedford Power Comapny, which is erecting a power-generating plant at Bedford, Ind., to cost $500,000.

The Baker Machinery Company, Des Moines, Iowa, has begun work on a new three-story factory. The company manufactures power-transmission machinery, freight and passenger elevators.

A technical high school is to be built in Jersey City, N. J., for which equipment for machine shop, blacksmith shop, foundry, etc., will be needed. Frank Sutton, 80 Broadway, New York, is consulting engineer.

The Reo Motor Car Company, Lansing, Mich., has decided to engage in the manufacture of popular priced motor wagons, and will erect a big addition. It is said 1000 more men will be employed.

The Mercer County Brewing Company is being formed to erect a brewery in South Sharon, Penn. C. P. McQuiggan, formerly president of the Windber (Penn.) Brewing Company, is at the head of the new company.

Chas. W. Warner, of Syracuse, N. Y., is interested in a project to build a $1,000,000 cotton mill, near Bristol, Conn. Mr. Warner is also interested in the Bristol Gas and Electric Company and the Bristol Belt Line Railway.

The Corry (Penn.) Metal Furniture Company, a new concern, has secured site and will erect a plant for the manufacture of metal bed-room furniture. Lathes, shapers, toggle presses, motors, etc., will be required. Jas. P. Brown is secretary.

Geo. W. Mueller, of the Mueller Manufacturing Company, Atlanta, Ga., is forming the Geo. W. Mueller Interior Company, and will erect a plant in Rome, Ga., for the manufacture of bank and office fixtures, etc., also bronze, brass, iron and steel fixtures.

F. B. Southwick & Co., Peabody, Mass., tanners and manufacturers of sheep skins, are erecting a new hydraulic-press house to accommodate four presses. Three presses have been purchased and the fourth one will be added as soon as necessity demands.

The Cyphers Incubator Company, of Buffalo, N. Y., has purchased site in Chicago, Ill., and is having plans prepared for the construction of a plant to cost $75,000. It is said the plant will handle 12,000 bushels of grain daily to be made into chicken food.

James Cunningham, Son & Co., carriage manufacturers, of Rochester, N. Y., who recently entered the automobile field are having a new building erected at 2341-2345 Michigan avenue, Chicago, Ill., to accommodate salesroom and manufacturing department.

The United Foundry and Engineering Company, Youngstown, Ohio, which will move its foundry department from the Lloyd Booth plant to make room for an addition to the machine shop there, will build an addition costing $25,000 to its Oak street plant to house the foundry plant.

The Chicago-Detroit Bag Company, Goshen, Ind., a new concern incorporated with $100,000 capital, has secured the plant of the Cosmo Buttermilk Soap Company, at Goshen, and will rebuild same, equipping it with modern machinery for the new industry. J. D. McBride, Geo. D. Adams, of Cleveland, Ohio, and others are incorporators.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids July 12, for four dump cars (schedule 2646), miscellaneous woodworking tools (schedule 2632); July 19—800 pounds welding compound, 2200 pounds lubricating graphite (schedule 2641), 50 gross hack-saw blades (schedule 2639), reamers, wrenches (schedule 2640).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: July 5—9400 pounds drawn brass (schedule 2634), twist drills, portable blacksmith forges (schedule 2636), propelling machinery (schedule 2633), 72,000 pounds steel floor plates (schedule 2637), 125 iron cocks (schedule 2634), 65 dozen brass petcocks, brass-pipe fittings, brass unions (schedule 2644), 30 steam traps (schedule 2637), steel and lead tubing (schedule 2636).

FIRES

James Strong, Ruscom Station, Ont. Stave mill.

Mohawk Brush Company, Troy, N. Y. Plant burned.

Bull's sawmill, Skibbereen, Ont. Loss, $40,000.

Adams Husker Company, Marysville, Ohio. Loss, $5000.

Dean Lumber Company, Elmira, N. Y. Plant destroyed.

Waterhead Corduroy Mills, Lowell, Mass. Loss, $35,000.

D. G. Griffith, Ogden, Utah. Ice plant. Loss, $20,000.

Illinois Refrigerator Company, Morrison, Ill. Loss, $10,000.

Greiss-Pfleger Tanning Company, Chicago, Ill. Loss, $350,000.

Obear-Nester Glass Company, Kansas City, Mo. Loss, $20,000.

National Fertilizer Company, Nashville, Tenn. Loss, $75,000.

Hanzel Elcock Company, Chicago, Ill. Foundry. Loss, $300,000.

Acushnet Saw Mill, New Bedford, Mass. Box factory. Loss, $50,000.

Cochran Brothers, McConnellsville, Ohio. Cigar factory. Loss, $12,000.

Tropical Oil Company, Cleveland, Ohio. Paint factory. Loss, $35,000.

Green Fuel Economizer Company, Matteawan, N. Y. Loss, $75,000 to $100,000.

Lewisburg Mill and Elevator Company, Lewisburg, Tenn. Plant destroyed. Loss, $9000.

Northern Foundry and Machine Company, Sault Ste. Marie, Mich. Plant destroyed. Loss, $30,000.

New Incorporations

J. Hackett Foundry Company, Charlotte, N. C. Foundry and machine shop. Capital, $125,000. Incorporators, J. Hackett, T. W. Long, etc.

Cluett & Sons, Troy, N. Y. Manufacture and deal in pianos, etc. Capital, $750,000. Incorporators, Chas. F. Cluett, A. E. Cluett, W. Irving Johnson.

Gunn Motor Company, Utica, N. Y. Manufacture and deal in motors, engines, etc. Capital, $300,000. Incorporators, J. K. Gunn, W. T. Baker, W. I. Taber.

Hughes Electric Heating Company, Chicago, Ill. Manufacture electric specialties. Capital, $50,000. Incorporators, G. A. Hunes, T. M. Craven, F. A. Cotharin.

Centrifugal Separation Company. Manufacture separating machinery. Capital, $30,000. Incorporators, H. de Raasloff, 471 Park avenue; T. E. Brown, 17 Battery place, etc.

Lancaster Lens Company, Lancaster, Ohio. Manufacture margin mirrors and lenses. Capital, $30,000. Incorporators, Edmund Dickey, H. W. Garrett, H. C. Watson, etc.

French Steel Products Company, New York. Manufacture automobile materials, appliances and supplies. Capital, $10,000. Incorporators, J. K. White, W. P. Frank, C. H. Owen.

Maximilian Tool and Machine Company, Buffalo, N. Y. Manufacture and deal in machinery, tools, etc. Capital, $50,000. Incorporators, Max Maximilian, F. A. Meyer, J. B. Porter.

Monsen Auto Garage, Chicago, Ill. Manufacture and deal in engines, vehicles, machinery, etc. Capital, $10,000. Incorporators, Wm. Brown, Wm. Sherman Hay, J. M. Wright.

Eclipse Electrical Manufacturing Company, Chicago, Ill. Manufacture and deal in electrical appliances. Capital, $15,000. Incorporators, W. E. Bodestab, John Renner, F. Kirchhoff.

Atlas Water Tube Boiler Company, Westmont, N. J. Manufacture water tube boilers, etc. Capital, $300,000. Incorporators, P. J. Dougherty, J. Barton Rettew, John Quincy Adams.

Standard Auto Sales Company, Youngstown, Ohio, sales agency and general garage business. Capital, $10,000. Incorporators, R. H. Anderson, A. Powers Smith, W. H. Anderson, etc.

Troy Wind Shield Company, Troy, Ohio. Manufacture wind shields and other automobile accessories. Capital, $10,000. Incorporators, H. F. Douglass, H. M. Allen, F. A. Dillingham, etc.

Rousseau Box and Shook Company, Rome, N. Y. Manufacture and deal in packing boxes and shooks. Capital, $20,000. Incorporators, C. D. Rousseau, J. F. Rousseau, F. G. Race, etc.

Vestibule Storm Front Company, Troy, Ohio. Manufacture storm fronts for all kinds of vehicles. Capital, $15,000. Incorporators, Philip J. Gates, Daniel Argenbright, Frank M. Sterrett, etc.

Matheny Grease Cup Company, Terre Haute, Ind. Manufacture grease cups for locomotives, engines, automobiles. Capital, $25,000. Incorporators, Jas. G. Matheny, E. E. Stien, J. J. Lynch, etc.

Farrington Automobile Company, Chicago, Ill. Manufacture and deal in automobiles and accessories. Capital, $10,000. Incorporators, Jos. T. Delfosse, W. H. Farrington, Samuel F. Scott.

Travis Glass and Dairy Supply Company, Cleveland, Ohio. Manufacture dairy machinery and glass articles. Capital, $10,000. Incorporators, C. F. Smith, Oliver K. Brewer, W. P. Kohn, etc.

National Corundum Wheel Company, Buffalo, N. Y. Manufacture and deal in abrasive wheels and machinery. Capital, $100,000. Incorporators, W. H. Farnsworth, C. W. Zimmer, L. H. Knapp.

United Self-Winding Electric Clock Company, New York. Manufacture electric self-winding clocks, etc. Capital, $100,000. Incorporators, C. P. Bowman, A. J. Bowman, M. M. Leavenworth.

Juenge Cutlery and Tool Company, Newark, N. J. Manufacture tools, cutlery, etc. Capital, $25,000. Incorporators, R. H. Juenge, Irvington; F. M. Hindenlang, T. G. Hindenlang, Newark.

Cincinnati Taxicab Company, Cincinnati, Ohio. Operate taxicab service and conduct automobile-repair shop. Capital, $20,000. Incorporators, Frank E. Burnett, A. L. Marshall, C. E. Everett, etc.

W. C. Fitch Hardware Company, Brooklyn, N. Y. Manufacture and deal in hardware, builders' supplies, etc. Capital, $50,000. Incorporators, Wm. O. Fitch, Edwin A. Fitch, Clarence E. Foster.

Hocking Light and Power Company, Nelsonville, Ohio. Build and operate electrical plant for furnishing light, heat and power. Capital, $10,000. Incorporators, H. H. Long, G. M. Murray, C. H. Davis.

Consumers Supply and Electric Company, Cleveland, Ohio. Manufacture and deal in mechanical and electrical supplies. Capital, $10,000. Incorporators, O. E. Conn, J. M. Martelock, B. J. Erhard, etc.

National Chambers Oven Company, Elmwood Place, Ohio. Manufacture apparatus for generating gas, making storage tanks, etc. Capital, $10,000. Incorporators, J. E. Stacey, R. J. Tarin, A. J. Stacey, etc.

Gas Light and Power Producing Company, Cleveland, Ohio. Manufacture and sell gas producers, engines, compressors, etc. Capital, $10,000. Incorporators, M. Miller, N. Varnes, H. L. Parmentier, etc.

Palmer-Herring Motor Company, Brooklyn, N. Y. Manufacture motors, engines, vehicles, etc. Capital, $20,000. Incorporators, H. W. Palmer, 282 Henry street; Chas. N. Herring, 103 Court street, Brooklyn, etc.

Everybody's Vacuum Cleaner Company, New York. Manufacture and deal in vacuum cleaners and supplies. Capital, $25,000. Incorporators, M. Rubens, Sheepshead Bay; R. Straschnow, H. F. Wolf, New York.

Wan To Pipe Threading Machine Company, Toledo, Ohio. Manufacture machinery for pipe-threading and plumbers' materials. Capital, $50,000. Incorporators, Chas. E. Bernet, Jay H. Miller, E. L. Thorp, etc.

Mogul Auto Company, Newburgh, N. Y. Manufacture automobiles, motor boats, etc. Capital, $100,000. Incorporators, Wm. L. Waller, New Windsor, N. Y.; C. M. Gilpin, Jas. M. Wright, 68 William street, New York.

Balance Gear Light Vehicle Company, New York. Manufacture vehicles, motors, engines. Capital, $30,000. Incorporators, W. E. McDonnell, New York; Thos. Spalding, Long Island City; M. J. McDonnell, Far Rockaway.

American Blind Stitch Machine Company, New York. Manufacture sewing machines and supplies, etc. Capital, $165,000. Incorporators, W. P. Hammond, Passaic, N. J. H. D. Sears, D. J. Sears, D. J. Newland, New York.

S. H. Pomeroy Company, New York. Manufacture and deal in "Hollow Metal" fire windows, etc. Capital, $132,500. Incorporators, S. H. Pomeroy, 102 Neptune avenue, New Rochelle, N. Y.; W. D. Lawton, Ridgewood, N. J., etc.

Motor Car Fixture Company, New York. Manufacture and sell automobiles, motor boats and accessories. Capital, $10,000. Incorporators, John H. Dale, W. I. Hess, C. P. Roen, all of Ninth avenue and Thirteenth street, New York.

Locomotive Superheater Company, Jersey City, N. J. Manufacture boilers, superheaters and accessories thereto, as applied to locomotives. Capital, $1,000,000. Incorporators, S. Hoffmann, F. V. Briesen, New York; C. N. King, Jersey City.

Seneca Falls Folding Box Company, Seneca Falls, N. Y. Manufacture and deal in paper, paper boxes, bags, etc. Capital, $100,000. Incorporators, W. Breese, Norwich; C. F. Wagner, B. H. Delavan, Baldwinsville, M. E. Pattero, Syracuse.

Business Items

Manning, Maxwell & Moore have opened a warehouse at 446-452 Communipaw avenue, Jersey City. The building is 200x100 feet, has 2700 feet floor space, and is equipped with a 7½-ton Shaw electric-traveling crane.

Barber-Colman Company, Rockford, Ill., has recently opened an office in the Ford building, Detroit, to enable its representative, H. C. Rose, to better take care of its increasing cutter business in that section. It is also this company's purpose to bring out a new line of tools in the near future.

The Nelson Iron Works, of Nelson, B. C., has taken over the business and stock of the Rossland Engineering Works, of Rossland, B. C., and will succeed that company as British Columbia agents for the Sullivan Machinery Company, of Chicago. An increased stock of Sullivan rock drills, diamond drills, hammer drills, air compressors and supplies for these machines will be maintained at Nelson.

The Jacobs Manufacturing Company, Hartford, Conn., recently posted the following notice in its factory: "This factory will remain closed for vacations during the first week of August. We now have unfilled orders for many chucks which our customers desire shipped immediately. It is very important that we deliver as many chucks as possible before vacation time, and we ask your hearty coöperation to that end. This factory will, therefore, run Saturday afternoons until August 1, unless we get caught up with our orders before that time. All of our employees who work as full time as possible until August 1 will be given a vacation for one week with full pay, paid in advance, and if we can arrange with Captain Jimmie, of Noank, we hope to give you a day's fishing with him, with all expenses paid. We hope that this plan will please you and that, in view of the fact that you will have the week's vacation with full pay, you will be willing to work Saturday afternoons when necessary."

TRADE CATALOGS

Wells Brothers Company, Greenfield, Mass. Catalog. Gages. Illustrated, 54 pages, 5x7½ inches, paper.

The A. & F. Brown Company, Elizabethport, N. J. Catalog. Machine molded gears. Illustrated, 210 pages, 4½x7 inches, paper.

Ingersoll-Rand Company, 11 Broadway, New York. Form No. 3023. Class OC duplex steam driven air compressors. Illustrated, 24 pages, 6x9 inches.

Standard Connecting Rod Company, Beaver Falls, Penn. Catalog. Finished crank shafts and connecting rods. Illustrated, 22 pages, 6x9 inches, paper.

Ingersoll Milling Machine Company, Rockford, Ill. Bulletins 18C, 19C. Milling machines for automobile and motor manufacturers. Illustrated.

Colburn Machine Tool Company, Franklin, Penn. Catalog A-1. Colburn new model boring and turning mills. Illustrated, 48 pages, 8½x10½ inches, paper.

Wisconsin Motor Manufacturing Company, North Milwaukee, Wis. Catalog. Gasolene engines for automobiles, trucks, launches. Illustrated. 8½x11 inches, paper.

The Carb-Ox Company, Rogers Park, Chicago, Ill. Catalog. Hays gas-analyzing apparatus, automatic damper regulator, etc. Illustrated, 16 pages, 4x8½ inches, paper.

FORTHCOMING MEETINGS

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

Society of Automobile Engineers, convention of designers and superintendents, July 28, 29 and 30, Detroit, Mich. H. E. Coffin, president, 1451 Broadway, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Mechanical drafting, special machinery designed, tools, dies, fixtures, etc.; charges reasonable. Box 669, AMERICAN MACHINIST.

Wanted—Work for first class machine shop; light, fine, special machinery, tools, jigs and experimental work. Boyce, 584 Hudson St., New York City.

Light, fine machinery and mechanical specialties built to order; jigs, tools, etc., designed and built. Goodson Electric and Manufacturing Co., Providence, R. I.

Does your gasolene motor run smoothly? If not, send 10c. postage for 56-page textbook on "Carbureters and Engine Troubles." Breeze Carbureter Company, Newark, N. J.

A well equipped machine shop within 30 miles from New York solicits orders for all kinds of machine work. Send inquiries: The Brunswick Refrigerating Co., New Brunswick, N. J.

Cincinnati shop has some spare capacity and is open to contract work for engine lathes, Jones & Lamson turrets, drill presses, milling machines and grinders. Box 633, AMERICAN MACHINIST.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Wanted—A concern consisting of foundry and machine shop, employing 150 to 200 men, would like to enlarge its business by manufacturing machines for other parties; estimates given. Box 662, AMER. MACHINIST.

Wanted—One 1x10 Pratt & Whitney turret lathe; one No. 3 Universal milling machine; one No. 2 vertical spindle milling attachment; one No. 2-H vertical spindle milling attachment; must be in good condition; state price. "A. P. M.," AMER. MACHINIST.

Oxygen-acetylene welding of all kinds of metals; crane facilities for handling the heaviest of pieces; we do light work also; our experience and success warrant us in giving a very liberal guarantee covering all of our work. Krajewski-Pesant Company, 52 Beard St., Brooklyn, N. Y.

Machine work wanted; we are in a position to manufacture special or staple articles in connection with our present line. Our facilities are such that we can employ one hundred and fifty men if necessary; our equipment also includes large case-hardening and tempering furnaces. Address H. G. Kotten Co., 30 Church St., New York City.

Machinists' and draftsmen's handbook; second edition, enlarged and revised; over 450 pages, including illustrations and tables for $2.50; from cover to cover it is full of valuable and helpful information; invaluable to the employer as well as the workman; don't send any money; simply send your order and receive the book on trust; look it over—if you like it, keep it; act today. Address Peder Lobben, Box 243, Holyoke, Mass.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Peterboro, Ont.

Wanted—Blacksmith foreman; a large agricultural manufacturing concern now building at Hamilton, Canada, require the services of a competent forge shop foreman, preferably one with plow manufacturing experience; this position offers exceptional opportunities to the right man; to receive consideration give detailed account of your experience covering the past two years, with references, and address Box 672, AM. MACH.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—Several first-class diemakers and toolmakers on light work; also machinists accustomed to light work; steady work and good pay for good man. Address Post Office Box 87, Station "A," Hartford, Conn.

Wanted—Salesmen to handle on a generous commission basis, a well advertising and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," AMERICAN MACHINIST.

ILLINOIS

Wanted—Tool designers; state age, salary, experience. The Buda Company, Harvey, Ill.

Wanted—Draftsman, experienced in automobile design, particularly motor and transmission; must be competent to check drawings; state age, salary, experience, etc. The Buda Company, Harvey, Ill.

Several experienced mechanical and structural draftsmen, $80 to $100 per month; several experienced detailers and tracers, $60 to $75 per month. In replying state experience in full. Box 691, AMER. MACHINIST.

Wanted—Chief draftsman in factory of special machinery, employing 300 men; must be man of thorough practical shop experience, as well as expert technical training, and of executive ability and experience to systematize work in drafting room, accurately check drawings and keep records; excellent permanent position for high-grade man. Box 661, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A first-class draftsman familiar with wood car detail. Box 621, AMER. MACH.

Wanted—Toolmakers, experienced on punch and die work. Apply Employment Department, General Electric Co., Pittsfield, Mass.

Wanted—Competent toolmaker for experimental work by Boston concern. Address, giving age, experience and other information. Box 680, AMERICAN MACHINIST.

Wanted—A thoroughly competent machine designer with inventive faculty and thorough knowledge of modern shop practice to work on special line of machinery. Apply by letter only, giving age, experience, reference and salary desired, to Room 809, 318 Main St., Springfield, Mass.

MICHIGAN

Wanted—A few first-class toolmakers experienced on die, jig and fixture work for light manufacturing. Box 592, AM. MACH.

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—First-class mechanic, uptodate in getting out production, as assistant superintendent; one who has held similar position, for a large automobile parts company; good position for right man; give references and experience. Box 651, AMERICAN MACHINIST.

MISSOURI

Wanted—Chief inspector; one familiar with steel bolsters and car work by large steel plant in West; one with car building experience preferred; give references and experience. Box 576, AMERICAN MACHINIST.

Wanted—A first-class foreman to take charge of machine shop of a western plant manufac-

turing gas engines and agricultural machinery; must be up to date in shop practice and experienced in handling men; give references. Box 670, AMERICAN MACHINIST.

NEW JERSEY

Draftsman Wanted—Assistant mechanical draftsman to design electrical machinery in Jersey City factory; state age, experience, and salary. Box 692, AMER. MACHINIST.

NEW YORK

Wanted—A draftsman, one preferred who has experience in engine and heavy sawmill machinery. Clark Bros. Co., Belmont, N. Y.

Wanted—A few first-class toolmakers on small accurate work; good wages and steady employment to competent men. Bundy Mfg. Co., Endicott, N. Y.

Wanted—Foreman for tool department and tool makers; state qualifications and rate wanted in first letter. The Kirkham Motor Mfg. Co., Bath, N. Y.

Wanted—Competent draftsman to make detail drawings of gas ranges; one experienced in die work preferred. Apply Superintendent, Rathbone, Sard & Co., Albany, N. Y.

Experienced machinery salesman wanted to sell the best portable electric tools on the market; improved designs of standard drills, reamers, etc., and several novel machines unlike anything on the market; this is the chance of a lifetime to help build up a business for we are a new corporation. Address Box 684, AMERICAN MACHINIST.

Wanted—Drop forge superintendent who can show a successful record, can obtain position with company in Pennsylvania, who will pay good salary to the man who can produce results; the man must be able to design dies, plan equipment, direct die and forge room foreman. In reply give references, age and salary expected. Box 688, AM. MA.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Forge Foreman Wanted—Large manufacturing concern, near New York, wants competent and experienced foreman for its forge and hardening department, employing 8 to 12 men; oil and gas furnaces and heating machines used; applicants must have had experience in handling men, case-hardening and treatment both carbon and high-speed steels. Address in confidence, giving full details of experience, age and salary expected. Walter H. Foster Co., 50 Church St., New York.

OHIO

Wanted—Foreman to assume entire charge of brass finishing department in large manufacturing concern, making a complete line of standard brass valves. Box 671, AM. MACH.

Wanted—In Cleveland, O., man to act as superintendent; must be experienced on metal stampings, such as trunk trimmings; must have experience for setting rates on piece work; give full particulars, where formerly employed, salary expected and age. Box 674, AMERICAN MACHINIST.

Expert salesman wanted by the Defiance Machine Works, of Defiance, Ohio; must be thoroughly familiar with the general woodworking trade in the United States; one conversant with wheel and wagon manufacturing preferred; applicants should be under middle age and able to give first-class references; a good position for a high-class man.

Superintendent—A business, employing 500 men, consisting of pattern, foundry and machine shop, manufacturing medium heavy machinery, desires superintendent with thorough knowledge of foundry and machine business; man must be systematic, and have held successfully position of superintendent in a modern organization; good salary and future with an expanding company; only men of ability need apply; location northern Ohio. Box 650, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

OREGON

Wanted—Competent machinists (strictly non-union) may secure steady work at wages from $3.50 up to $4.50 for 9-hour day; high grade work with modern tools in a comfortable, well lighted shop located in the finest country in the United States. Willamette Iron & Steel Works, Portland, Ore.

PENNSYLVANIA

Wanted—Floor hands and fitters on machine tool work. Colburn Machine Tool Co., Franklin, Penn.

Wanted—Lathe, boring mill and floor hands; good wages, steady work. The Blaisdell Machinery Company, Bradford, Pa.

Wanted—Jig and tool draftsmen accustomed to automobile work. Reply, giving experience, age and salary expected. Box 645, AMERICAN MACHINIST.

Machinists — Machine operators wanted; plenty of work, nothing but sober and steady men need apply. Standard Engineering Company, Ellwood City, Pa.

Wanted—Two experienced checkers and two experienced structural draftsmen wanted by a large firm, on mill buildings, etc.; location, eastern Pennsylvania. Write, giving age, nationality, education, experience and salary expected. Box 660, AMER. MACHINIST.

Steel Salesmen—We want several general steel salesmen of experience and ability; experienced in high-speed steel, alloy and crucible carbon steels; this opportunity is a most excellent one for the right men, who are qualified in every respect to become high-grade sales managers. Address "V. A. S.," AMERICAN MACHINIST.

We are increasing our force and invite applications from machine hands of all kinds, including men who can turn multiple throw cranks, bench hands, erectors, metal polishers, and Jones & Lamson turret lathe hands; shop located near Philadelphia and building marine gas engines; no labor troubles; give experience in detail. Box 591, AM. MACH.

Machine shop foreman wanted for foundry and machine shop; must have had some experience in machine tool building and in general repairs; shop employs about 40 hands and is situated in Pennsylvania, in the Schuylkill valley; give full particulars referring to recent employers, giving experience, age and salary expected; replies will be treated confidentially. Box 664, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Ten draftsmen and designers; must be experienced and practical, capable of designing jigs, fixtures and punches and dies for the economical manufacture of automobile engine parts, also interchangeable parts for small automatic machines. The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

WISCONSIN

Wanted at once, automatic screw machine operators; men capable of setting up and operating Cleveland automatic screw machines; state compensation expected, experience, references and how soon can start work. Box 676, AMERICAN MACHINIST.

Shop man who understands the rapid and accurate production of small, interchangeable parts, and who has a good knowledge of production of stampings; must be sober, energetic and good mechanic; state age, experience, salary expected, where employed at present, and reasons for desiring a change. "X. Y. Z," AMERICAN MACHINIST.

SITUATIONS WANTED

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CONNECTICUT

A production man with extensive and valuable experience in the manufacture of medium sized machinery, and also thoroughly familiar with bonus and piece-work methods, desires a situation as production or assistant mechanical superintendent; location desired, New England or Middle Atlantic States. Box 667, AMERICAN MACHINIST.

ILLINOIS

Experienced, practical, systematic, superintendent in charge of a large manufacturing plant, wishes to make a change. Box 686, AMERICAN MACHINIST.

MASSACHUSETTS

Expert tool and die maker wishes position as foreman of tool room or master mechanic, with all uptodate methods. Box 675, AM. M.

Draftsman—Young man, age 24, with five years' experience on mechanical drafting, details and layouts, would like to secure position with firm where there is chance for advancement. Box 677, AMERICAN MACHINIST.

NEW JERSEY

Foreman wishes position in machine shop or auto repair shop; well experienced; good references. Box 657, AMERICAN MACHINIST.

NEW YORK

General foreman, 39, up to date in modern methods of manufacture, now employed, desires change; good reference. Box 626, AM. M.

Hardener and temperer and case-hardener wants a change; used to all kinds of high-speed carbon steels. Box 690, AMER. MACH.

Foreman toolmaker, up to date in modern shop methods, jig and fixture designer, steel trim and molding a specialty. Box 678, AMERICAN MACHINIST.

Designer, graduate, 2 years shop, 12 years office; exceptionally competent on special and automatic machinery, typewriters, adders and fine experimental work. Box 681, AM. M.

Expert on hardening and tempering all kinds of tool steel, high speed steel and case-hardening, 15 years' experience, wishes position; can furnish best recommendation. Box 673, AMERICAN MACHINIST.

Foreman machinist with executive ability, wishes a position; large experience in handling help; experienced on engine and machinery of all kinds; excellent references. Address S. T., 5124 Ninth Ave., Brooklyn.

German machinist and toolmaker, 36 years of age, 18 years' experience building tools, jig experimental work, automatic machinery, also die work, wants steady position in New York City or vicinity. Box 689, AM. MACH.

Wanted—Position as superintendent or master mechanic; thorough technical and practical all-around designer, foreman, toolmaker and mechanic; executive ability; A-1 references. Box 685, AMERICAN MACHINIST.

Position as draftsman or designer wanted by technical graduate with one year's shop practice and 4½ years' drawing room experience on general machine work; good checker and accustomed to taking care of work. Box 682, AMERICAN MACHINIST.

Manufacturers of machine tools and equipment desirous of establishing an agency in central New York, Ohio and Pennsylvania; can secure the services of experienced salesmen connected with successful engineering company. Address "Energy," AMER. MACH.

OHIO

Experienced superintendent, now employed, is open for change; expert on light and medium machinery, automobile work and sheet metal stamping; drafting room experience, and all-around factory man; American, strictly sober, honest and industrious; location, northern Ohio. Box 683, AMER. MACH.

PENNSYLVANIA

I am a machinist and want a job. Box 687, AMERICAN MACHINIST.

RHODE ISLAND

Able salesman, traveling New England, desires change; represent progressive concern manufacturing high grade product; aggressive, systematic, resourceful; familiar with power and machinery line; confidential correspondence invited. Box 679, AMER. MACH.

FOR SALE

For Sale—Interest or control in manufacturing business; exceptional opportunity for manager or instrument maker. Box 516, AMERICAN MACHINIST.

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; good opening for manufacturing business. Geo. H. Church, Bergen, N. Y.

For Sale—McIntosh-Seymour vertical cross-compound non-condensing engine; cylinders 16" and 28" with stroke 24"; direct connected to Stanley three-phase alternator, inductor type, 440 volts, 60 cycle; we have been taking 500 horsepower from it. The Davis Sewing Machine Co., Dayton, Ohio.

For Immediate Sale—Two 26" Gisholt turret lathes, latest type, in perfect condition, fully equipped with all adjustments; one of them is a new machine which has been in use but a few months; special spindle in one takes in 5" stock, the other is standard. Standard Roller Bearing Co., Philadelphia, Pa.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.